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"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

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CONTENTS

	Page
THE SAGA OF BIG GAME FISHING.....	<i>Ralph Bandini</i> 173
THE COMMERCIAL USES OF SHARKS AND RAYS.....	<i>Lionel A. Walford</i> 179
IN DEFENSE OF PELICANS.....	<i>Ben S. Thompson</i> 188
CALIFORNIA STEELHEAD TROUT PROBLEMS.....	<i>A. C. Taft</i> 192
CONDITION OF THE YELLOWTAIL FISHERY.....	<i>S. S. Whitehead</i> 199
FROGS AND THEIR COMMERCIAL USES.....	<i>Tracy I. Stover</i> 203
EDITORIALS.....	214
COMMERCIAL FISHERY NOTES—	
TUNA BY RAILWAY FROM MEXICO.....	220
THE MACKEREL INDUSTRY.....	220
A MARINE DRAMA.....	220
TUNA TENDERS AT THE EQUATOR.....	222
CLAMS FROM LOWER CALIFORNIA.....	222
DIVISION ACTIVITIES.....	226
STATISTICS—	
DEER KILL FOR SIX YEARS.....	between pages 230- 231
STATEMENT OF INCOME.....	231
STATEMENT OF EXPENDITURES.....	232
VIOLATIONS OF FISH AND GAME LAWS.....	234
FRESH FISHERY PRODUCTS.....	236

THE SAGA OF BIG GAME FISHING

By RALPH BANDINI

FROM THE BEGINNING of time, what man or woman has lived who, at some time in his or her life, has not thrilled to the lure of fishing? Looked at dispassionately it does seem a silly sort of thing—this talk of thrill in fishing—and yet, show me the human being who feels no prickle up and down the back, with his first cast into a deep, still pool, or the fluttering sinking of his bait

into dark waters, and I will show you him who knows not the joy of living!

Generally speaking, fishing, or to use the more technical term, angling, is most often thought of in connection with some wooded stream, a drowsing lake, or mountain torrents, and the quarry sought, if it should attain the astounding weight of 10 pounds or so, a thing to marvel at, to brag about, and, perhaps, about which to weave prodigious lies.

Hand in hand with angling walks its companion sport, hunting. We all remember planning for months, days and weeks toward a few days in the wilderness—toward the pursuit of something feathered, furred or antlered. When those too few days have finally arrived, they have sped all too swiftly. For months afterward we dream of those brief hours wherein we lived adventure, communed with nature, and lifted ourselves from out the rut into which most of us are condemned. Furthermore, always we eagerly devour all works devoted to Big Game hunting (I use the capitals deliberately) and we shiver in our easy chairs as we read of the adventurous sportsman who, scorning the security of fireside, risks life, limb and, this most assuredly, comfort, that he may match wits and skill with ferocious beasts.

Now, granting all the interest in Big Game hunting, I wonder how many of us realize that there is such a thing as Big Game fishing? That there, out upon the sea and in the quest of tuna and swordfish, are the same thrills, the same element of personal risk, the same pulse-stirring matching of wits and skill, as can be found in any hunting? Not many, I fear. But the fact remains, just the same. So, hoping to bring you something new—this publication frowns upon sheer, stark adventure—I endeavor to implant within your minds some seed of thought pertaining to this Sport of Kings—Big Game fishing—and particularly to relate its history and development.

In the first place, all Californians should glory in the fact that the birthplace, the cradle, of deep sea angling is California, on Santa Catalina Island off the Southern California coast. There the sport came into being, there it developed, and from there its seed has spread throughout the world. I tell you without fear of contradiction that there is no sea angling club in the world which has not turned to the old Tuna Club of that island for the fundamentals of their rules. Now let us see how this all came about.

Back in 1898 the late Dr. Charles Frederick Holder, an enthusiastic sportsman and angler, heard weird tales of a fish called "leaping tuna" which frequented the waters about Catalina Island. They were declared to be quite uncatchable, unless one used hand tackle closely akin to hawsers, but a very wonderful fish withal. Holder had had long experience in game fishing. He had conquered the fighting muskelunge, the great salmon of the Northwest, the tarpon of Florida waters. Surely these tuna would be meat for his pot. So, always seeking adventure, he determined to go and see for himself—an excellent policy for all of us to follow.

What he found amazed him. He saw great schools of huge fish rollicking up the channel. He found men, equipped with little short of windlass and rope, seeking to subdue them. Even then these so-called sportsmen rarely could claim victory. He found the com-

mercial fisherman shaking their heads and refusing to have aught to do with such a quarry. But most of all, within himself he felt growing the spirit of high adventure—the spirit to risk all in hand to hand encounter with these gentlemen adventurers from unknown seas. Vaguely, half doubtingly, he knew that here he had encountered the sport of kings.

Back to the mainland he went and proceeded to equip himself with that which he conceived to be adequate tackle for the task before him. Now, I have seen this very same tackle with mine own eyes. First I felt the desire to laugh, then to cry, then, as full realization of what it meant came to me, to abase myself to the man who dared to use it! You big game fishermen of today (and I am one of you) look at that which I looked at.

A wooden rod of green heart and in three parts—three parts, mind you, with their accompanying points of weakness in seats and ferules. A reel—something to marvel at. Crude, small, action like a coffee mill, a free handle that spun around with incredible speed under the long runs of the fish; no break other than a thumbstall of leather. A line, well, words fail me. Today we who test and retest our lines that we may be sure of securing the last ounce of strength, and we demand a 66-pound breaking strain for our 24-thread ones, we should be ashamed of ourselves. In another thing these first lines were different. Dr. Holder considered that 21 thread was sufficient (his opinion is still correct, breaking strains were not thought of in those days nor was the quality of cotton used considered of any importance. Most anything would do for a “fish line.” So, the manufacturers contented themselves with about two pounds to the thread, more or less, and mostly less, giving a line which broke at around 42 pounds.

Next came the leader. Was it the modern multiple strand cable? Was it even the older piano wire? It was not. It was soft copper wire which most modern anglers would hesitate to use on a mackerel. As for the hook—well, hooks have not changed greatly over the years, but I doubt that the hook which took the first hundred pound tuna would last long in our tackle boxes.

So much for the tackle. Now comes the boat. Remember that launches were few and far between back in 1898 and especially on the Pacific coast. Holder had to use a rowboat, an ordinary round bottom skiff with a board across the stern as a seat. Even so, excepting for the lack of a modern fishing chair, he was not so badly off. On the contrary, there is some advantage in fishing for a heavy, slow moving fish from a skiff. In moments of dogged give and take fighting you can pull the skiff over to the fish. You can't a modern launch.

With his own words Dr. Holder has told me of those first days of his venture; of the disappointments, the discouragements he encountered. How he watched the great schools of tuna go rolling up the channel, as far removed from him as though they had been in the moon, partly due to the fact that for speed he was dependent upon oars, and partly due to rough water. Think of that, you anglers who possess 20 knots or better! How, when he did get into a school, either they would not bite, or there would be a furious strike, a mad rush, and a broken line. Old fishermen wagged their heads and mumbled about “crazy fools.” Even he felt the growing suspicion that he was endeavoring the impossible.

Then came a never-to-be-forgotten morning. I can see the picture as I write. The fog is lifting over the island, the sun peeping through, changing the gray sea to gentle blue, a blue edged with a narrow band of white, the surf, which washes against steep, brush covered hills. Early in the morning a market fisherman came in and reported tuna off Gallagher's, a few miles west of Avalon village. Hastily Holder gathered together his tackle, shoved off in his rowboat and was pulled sturdily up the coast by Jim Gardner, his boatman.

They found the fish, just where they had been reported, and still surfacing. Dark ripples of traveling schools marked the surface. Here and there boiling swirls broke as huge black bodies lunged. Sardines, smelt, anchovies were flying in every direction, mad with fear. Sea birds swooped down to the kill, screaming. It gave every promise of being the day of days.

Very carefully the bait was put on and one last inspection of tackle made. Most probably a fervent prayer to the gods of fishermen accompanied the shimmering flying fish as it floated away astern. Holder has never confessed to this, but I know my anglers. Jim pulled stoutly toward the nearest school. Swift, shining bodies, darting like flashes of light in the clear depths beneath, began to appear on all sides. It is not hard to picture the tension in that little skiff.

Suddenly there was a boiling swirl, by the bait. A miss! Then another swirl! A sharp tug, a furious rush, and the rod bent and buckled, the reel screamed! The fight was on!

It is not my purpose herein to describe that epic battle, although in it there were contained thrills enough to make a story. Furthermore, I have been sternly advised by the sponsors of this publication that I must confine myself to cold, technical facts. Even they, however, can not prevent me from adding that, after hours of almost superhuman struggle, after distracting moments when everything seemed lost, human courage and human skill prevailed and a desperately fighting, shimmering blue-green shape was slowly drawn alongside. And so was taken the first hundred pound tuna on rod and reel.

Holder was delighted, naturally, but, being of that rare breed, a true sportsman, he could not rest happy until others had tasted of his cup. Accordingly, he hurried back to the mainland and by letter and telegram told of what he had encountered and begged his friends to come with all speed to this island Paradise that they might share in this new found sport. They came—one, two, three, a few, cautiously, doubtingly, more than a little inclined to take with a grain of salt their good friend's enthusiasm.

Those were great days that followed. As a little boy (not so little after all when you come to think of it, more of a lad) I was privileged to see them. I saw great anglers go out upon the sea, hopeful and confident. I saw these same great anglers return, bruised and beaten, hands and fingers a mass of bloody bandages where the free flying reel handle had caught them unawares. But beaten or otherwise, they all came back with breath taking tales of great, surging fish, unconquered and unconquerable, and showed as evidence, broken rods, broken lines, and half capsized skiffs. But some of them caught fish, not many, but enough to urge the others on to greater endeavor.

Almost at once Dr. Holder and this little coterie of anglers recognized the need for some sort of orderly regulations to govern the sport. They met one day in the old Metropole hotel, formed what they named the "Tuna Club," adopted a code of tackle specifications and of rules, and awarded a blue Tuna Button to the lucky angler taking a hundred pound tuna or better under these same rules. From that informal beginning came the parent of all sea angling clubs in the world, an organization which today, 33 years later, has upheld the standard of "fewer fish and more sport" and which is everywhere recognized as the leader among its fellows.

With the formation of the club and the growing popularity of the sport, men began coming from all parts of the world to try their luck. Naturally, the minds of these men soon began to turn toward improving the crude tackle used. First came the matter of lines.

Holder's 21 thread was deemed inadequate and 24 thread was adopted in lieu thereof. Line manufacturers were importuned to devote more care toward the construction of tuna lines. Wealthy anglers even had their lines made to order. It wasn't long before 24 thread lines with a breaking strain of 50 to 55 pounds began to make their appearance.

Next came the reel. Some method must be found to offset that dangerous, free-flying handle; to permit the line to pay off freely under a regulated strain and without movement of the crank. No man could be expected to submit to the battering that those early anglers endured. In fact it became a local joke to refer to a certain corner of the Metropole veranda, where sat disgruntled fishermen nursing their wounds, as the "Tuna Hospital."

At last came the first solution. The late F. J. Rabbeth devised an outside drag, a metal disk which would not turn if held by the angler and which permitted the line to pay off under a tension without the crank turning. From then on development was swift. An inside drag was invented with a post, or stop, screwed into the face of the reel and releasable by a spring, against which the reel handle would come to rest and hold. Then, it was by the Vom Hofes I think, that the inside drag principle was improved, an inside dog engaging reel gears developed and the brake tension regulated by a small star wheel fitting on to the reel post just under the handle. This reel was called the "Star Special" and from it developed our present day reels—reels that will stand incredibly long rushes by great fish, and which will stand up under long hours of gruelling fight. They are built with the beauty and precision of a watch and the strength of a locomotive. And that is as it should be. Nothing is of greater importance than one's reel. A poor rod can be handled carefully and made to serve. A bad line can be nursed along until it has done its work, but a poor reel will always end in tragedy.

Along with the reels, rods were improved. It soon became apparent that the old three-piece, jointed contraptions were useless. That they buckled and broke at every joint. To correct these defects a two-piece rod was developed, one consisting of butt and tip, the butt being heavy and adapted for the seating of the reel and to receive the more slender fighting tip. At first rods were of greenheart, basswood or hickory. Then split bamboo came into use, the field narrowing to hickory and

bamboo, where it remains today. Probably no better rod exists than a *good* hickory, but be very careful that it is good before you buy it. Then came two-skin rods—by that I mean one bamboo rod built over the other. These were followed by dual and triple wood rods. All have their followers, all their particular advantages.

Leaders soon changed from copper wire to strong, high test piano wire. This lasted without improvement until about 1920 when the multiple strand, flexible cable leader came into being. As a matter of fact this type of leader was developed by reason of broadbill swordfish. The broadbill, being a slow moving, slow fighting fish, is inclined to roll up in the leader, to beat it with his sword. More often than not these tactics result in his wrapping the leader around and around his sword. When one of these loops slipped off, tightened up and kinked, that fish was gone. With the cable leader he can roll as much as he pleases, in fact, the more he does the more likely it is that the flexible leader will foul him somewhere, at some point, to an extent that will cripple him. But, even so, the flexible cable leader is of no particular value in the taking of tuna and marlin swordfish. The old piano wire is still used.

Perhaps the most ingenious contraption used in the taking of fish is the kite, without which our Pacific bluefin tuna can not be taken. For a time tuna readily took a bait trolled directly behind the boat. Then, suddenly, they changed their tactics, refusing to have aught to do with such a simple method. Anglers were in despair. Then one inventive soul, Captain George Farnsworth, began experimenting. What he tried, only he, himself, knows. But at last he hit upon the kite and from then on he and his anglers were the envy of all. Finally, when less fortunate ones almost reached the point of giving up tuna fishing forever, he very generously gave out his secret. It is this.

Take a silk kite anywhere from 28 to 36 inches square and run it out as many hundred feet as your fancy dictates. Strand the end of the kite line to one strand, peeling the others back about a foot and tie that single strand to your fish line at a point above the leader according to the force of the wind. Then let out 100 or 150 feet of your fish line. Set a course for the boat that will permit the bait to travel abeam or a little aft of beam and out to one side of the boat. Skip the bait by long sweeps, and jerks of the rod. The idea is to keep the bait skipping along the surface, entirely away from any disturbance of the wake. We have found that bluefin tuna will not strike if the wake of the boat reaches them before the bait. Simple, isn't it? And yet it is the only way you can get these fish in our waters.

So, there you have it, the brief history of deep sea angling as a competitive sport and how tackle developed to its present state through the travail and inventive genius of man. It is a grand game, this Big Game fishing; one that will blow the cobwebs out of your head and give you a better perspective on life than the ordinary rut will permit. It is a game well worth preserving, not alone for our own amusement but for what it will give to generations to come.

Now, before I say "adios," may I do one thing? Offer my most respectful salute to those splendid gentlemen who brought to us this sport. I don't know where they have gone, nor do I care, other than to wish them "good fishing" wherever their paths may lie.

COMMERCIAL USES OF SHARKS AND RAYS¹

By LIONEL A. WALFORD

THERE ARE 23 kinds of sharks and 15 kinds of rays recorded from the coast of California. Of these, about 12 of the former and eight or nine of the latter may be considered common enough to be caught almost any time; the rest are only occasional or rare visitors. Commercial fishermen, catching these fish only incidentally while fishing for other things, discard the greater part of the shark and ray catch as unmarketable, killing the fish and throwing them back into the sea. Sport fishermen, fishing in sloughs, along the shore from pleasure piers, and from pleasure boats, likewise often catch these fishes, and usually also cast them aside as worthless. This wastefulness is simply another sign of the great wealth of the country, which permits people to choose only the choicest morsels in the ocean and to destroy whatever else they find. As it becomes necessary for fishermen to look for more expensive species farther and farther away, as present trends indicate, it is possible that attention will be drawn to the cheaper grades of fish nearer home. It is characteristic of older fisheries centers, that the people utilize the marine products to a much greater extent than we of a new fishery center do. In Europe, for example, many sharks and skates bring almost as great a price in the markets as the other kinds of fishes, and shark liver oil is accepted as a satisfactory substitute for cod liver oil. In Asiatic countries, likewise, sharks and skates are important food fishes. On the Atlantic coast of the United States, shark skins are utilized in manufacturing leather. In Australia, besides taking sharks for their hides and for the manufacture of fertilizer, people find a rather large market for the teeth of some of the larger specimens, as ornaments. In California more use should be made of these fishes than is now done.

The form of the California species varies considerably from the fusiform, speedy-looking great blue shark, to the flat, bottom-living round sting ray. The hammerhead shark, the swell shark, the thresher, the manta, all have curious specializations of form. Some knowledge of the different kinds of these fishes will help one to understand their different uses and possibilities; for, of course, there is no uniformity of quality among the different species. Some may be useful for their hides, others for their oil—and the oils of different species are of different chemical constitution—others for their flesh, and some are of doubtful value for any purpose. The numbers and habits also vary. Most of the larger sharks are rare on our coast, and some of the rays which grow to large size are not taken in great quantity. Although there is unquestionably a fairly large population of these fishes in California, they do not at all compare in numbers with the bony fishes. None of the sharks or skates occurs in schools comparable in size or density to those of the California sardine, barracuda, mackerel, or

¹ Contribution No. 133 from the California State Fisheries Laboratory, December, 1931.

yellowtail, for example. In planning a business of shark and skate utilization, therefore, it is important to remember this fact. Enthusiastic as people have become over the prospects of manufacturing various products from these fishes, they have found difficulty in getting sufficient material.

SHARKS AS FOOD

The use requiring the least investment, handling, and cost, of course, is food. While sharks and skates are not considered by some to be as fine as some of our other fishes, they should find a fairly large market among people who can not afford to pay the high prices demanded for such fishes as tuna, salmon and halibut. If properly prepared, some of the sharks, and many of the skates compare very favorably with more popular fishes. In fact, many people who "would never touch shark," frequently eat it and enjoy it under such names as "fillet of sole," "tenderloin of sole," "fillet," and even as "sturgeon!" Unfortunately, there is an old prejudice against sharks on the part of many people. The reason for this prejudice is the old belief that all sharks are inveterate man-eaters. This, of course, is absurd. If sharks had to depend for their living on eating people, there would be no sharks left, for there aren't enough people available in the water to feed a shark population. Besides, most of our sharks are rather small, with small teeth. Like most of our market fishes, they feed on smaller species of fishes and on invertebrates, which swarm the sea in unbelievable numbers. The largest of our sharks, the basking shark, eats only very tiny marine organisms. Although it is true that some sharks do attack human beings, most of these attacks are laid to one species, the great white shark, which is taken in California only rarely. Nevertheless, there is this superstitious pre-judgment, and even though it is gradually being overcome by advertising, it is still in the way of making shark fishing for the markets a dependable venture. In California, sharks and skates are sold in fair numbers in the markets of San Pedro, and to some extent in San Francisco, but in the other fishing ports of the State, there is but slight demand for them. In San Pedro, the sharks are prepared by beheading, removing all the fins, cleaning, skinning, and finally filleting. As steaks, they appear in the retail markets, usually under the name of "fillet," and sell from 10 to 20 cents a pound (1931). Fishermen receive usually in the neighborhood of three cents a pound. Skates, which bring about the same price, are prepared for market by removing the head, gut and tail, leaving only the pectoral fins. They are sometimes filleted, sometimes sold under their own name. Both sharks and skates may be cooked like any other fish, without any special preparation.

SHARK FINS

Although shark fins are usually cut off and thrown away by fishermen and marketmen, they are much appreciated by Chinese, Filipinos and other oriental peoples, who pay as high as \$2.50 a pound retail for prepared fins. Several tons a year are imported from the west coast of Mexico, either to be shipped from California ports to the Orient or for local consumption. Sometimes fins are imported even from China for

the American-Chinese trade. Merchants say that the demand for fins far exceeds the supply, as they are not only expensive, but often difficult to obtain. The wholesale price paid in 1931, from 15 cents to \$1.50 a pound, while not enough to support a special industry, certainly gives opportunity of a profitable side line.

All fins are used, provided they are at least six inches long, though the tail fin is of slight value. The species of shark from which the fins



Fig. 56. The cartilaginous rays from a shark fin, as sold in Chinatown, San Francisco. This is the part used by Oriental people for making soup. Photo. by L. A. Walford.

are taken seems to be unimportant, so long as the fins are large enough and have good-sized cartilaginous rays in them.

The preparation for the market is as follows: After the fins are cut from the body and the flesh cut entirely away, leaving only the fin, they are washed thoroughly in sea water. They are then spread out, preferably on chicken wire stretched two or three feet above the ground, and left in the sun for about 14 days until they are stiff and hard as a board. For the first few days the fins should be taken under

shelter during the night to protect them from moisture. They must never, during the drying process, be stacked. After they are dried, the fins should be packed in 200-pound lots in cases or barrels for shipment.

In preparing the fins for use, the Chinese soak them in warm water until the flesh softens and the cartilagenous rays can be separated out. These rays keep indefinitely when dried and are sold in retail stores. They are sliced up and boiled with chicken or other meat in the preparation of soup.

LEATHER FROM SHARKS

For many years, the only commercial use of shark skin was for making sword hilts and as an abrasive for polishing wood, ivory and other surfaces. Because these skins are covered with an armour of deeply imbedded hard scales, called shagreen, which are very difficult to remove, they could not compete with the skins of mammals in the commercial markets. In 1919 and 1920, Kohler and Tressler² separately developed and patented processes for removing this shagreen, thus opening up a new use for shark skins. These patents were assigned to the Ocean Leather Corporation of Newark, New Jersey, which seems at present to be the only producer of shark leather in the United States. Their product, known as *Eastern Shark Leather* and as *Olcotrop Shark Leather*, is used in manufacturing luggage, shoes and other leather goods, being superior in wearing qualities to ordinary leather, and of a very attractive appearance. The principal sources of supply are the fishing stations which this company has developed along the Gulf of Mexico, the Caribbean Sea and the West Indies. Although this firm receives some shark hides from the west coast of Mexico, these are not properly prepared.

Because they produce three different natural grains of leather, for the convenience of the trade, shark skins are divided into three classes: "Eastern," "sawfish" and "nurse." Since this industry has not been introduced to the west coast and in the absence of special investigations, we can not tell which of our sharks are suitable for their skins. The leopard, the bonito and the hammerhead sharks, however, are similar to eastern forms and are classed by the Ocean Leather Corporation as "eastern sharks." There is no sawfish shark or nurse shark in California. Nevertheless, there are several kinds of California sharks which should provide hides comparable with the eastern species which the Ocean Leather Corporation lists. This company pays (1931) for skins according to size and condition, from about 25 cents each for hides measuring 25 to 34 inches from tip to tip, to around \$5 for those measuring 125 to 135 inches. A bonus is given for perfect hides having no holes or no sour (rotten) spots; deductions are made for holes and sour spots, and hides having many holes and sour spots over the entire surface are not accepted.

DIRECTIONS³ FOR PREPARING SHARK HIDES

Skinning

It is very important that the shark be skinned as soon as possible after being caught. Since any shark will spoil within twenty-four

² Tressler, Donald K. Marine products of commerce. New York, 1922, p. 494.

³ Supplied by the Ocean Leather Corporation, Newark, New Jersey.

hours, the hides as well as the by-products have to be prepared and cured within a few hours after the shark is removed from the water. It is important to avoid exposure to the sun and to keep hides or any shark products from coming in contact with fresh water.

The first operation is to remove with a sharp knife all the fins and the tail, cutting in a curve into the fins, in order to leave little or no meat or skin on the fins. The tail is to be cut completely off just above the root. The fleshy part of the fins, which now remains, should then be trimmed off as close as possible to the carcass. (See Figs. 57 and 58.)

The second operation is to insert the knife, which should be very sharp, in the holes made by removing the dorsal fins and to split the

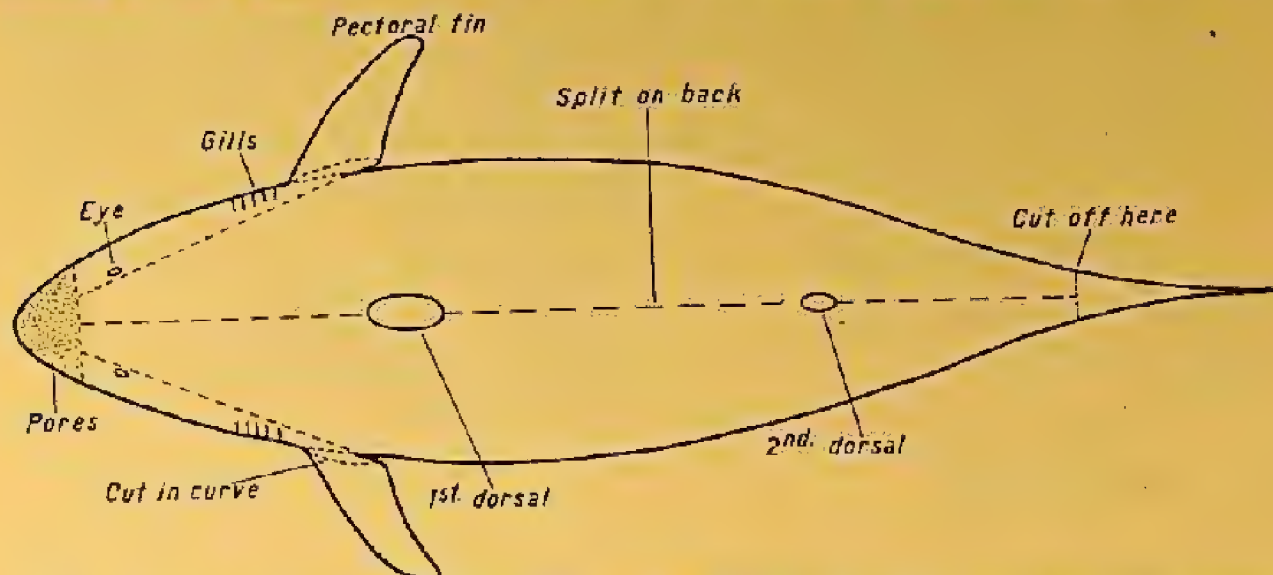


Fig. 57. Diagram of a shark's back. The dotted lines show where to cut in preparing for skinning. Modified from a bulletin issued by the Ocean Leather Company.

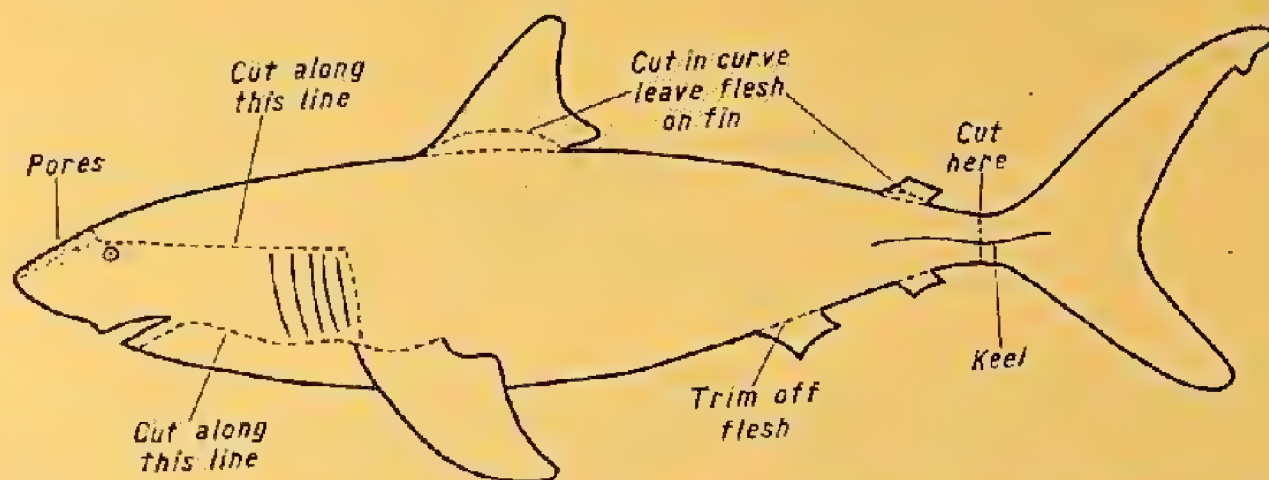


Fig. 58. Diagram of the side of a shark. The dotted lines show where to cut in preparing for skinning. Modified from a bulletin issued by the Ocean Leather Company.

hide along the back as straight as possible, first toward the tail end to where the tail has been cut off, then toward the head to a point where the head is perforated with numerous small pores. On some species these pores begin five or six inches from the tip of the snout. Then from here, cut (on each side) toward the undersurface of the fish to a point in line with the eyes and top of the gills; then cut toward the pectoral fins, passing just above the eyes and just above the gills, until the holes made by removing the pectoral fins are reached. Now proceed to cut again in the direction of the jaws, passing this

time just below the gills. Lay the shark on its back and proceed to cut toward the lower jaw, and cut along the rim of the mouth, keeping an inch or two from the edge. These two cuts, one on each side, will meet midway under the mouth, and this part of the hide constitutes the chin flap.

The third operation is the actual skinning. Turn the carcass on its belly and straddle the back, facing in the direction of the head. Take in the left hand the left side split of the section of the hide near the head, holding firmly while the right hand operates the skinning knife, which must be very sharp, and peel the hide off by cutting away the carcass. To avoid cutting the hide, great care must be taken in operating the skinning knife. Since too close skinning may easily result in accidental cuts, it is easier to leave considerable flesh on the hide and to remove this later by fleshing. After the left side is skinned, turn around facing the tail end, and skin the other side in the same

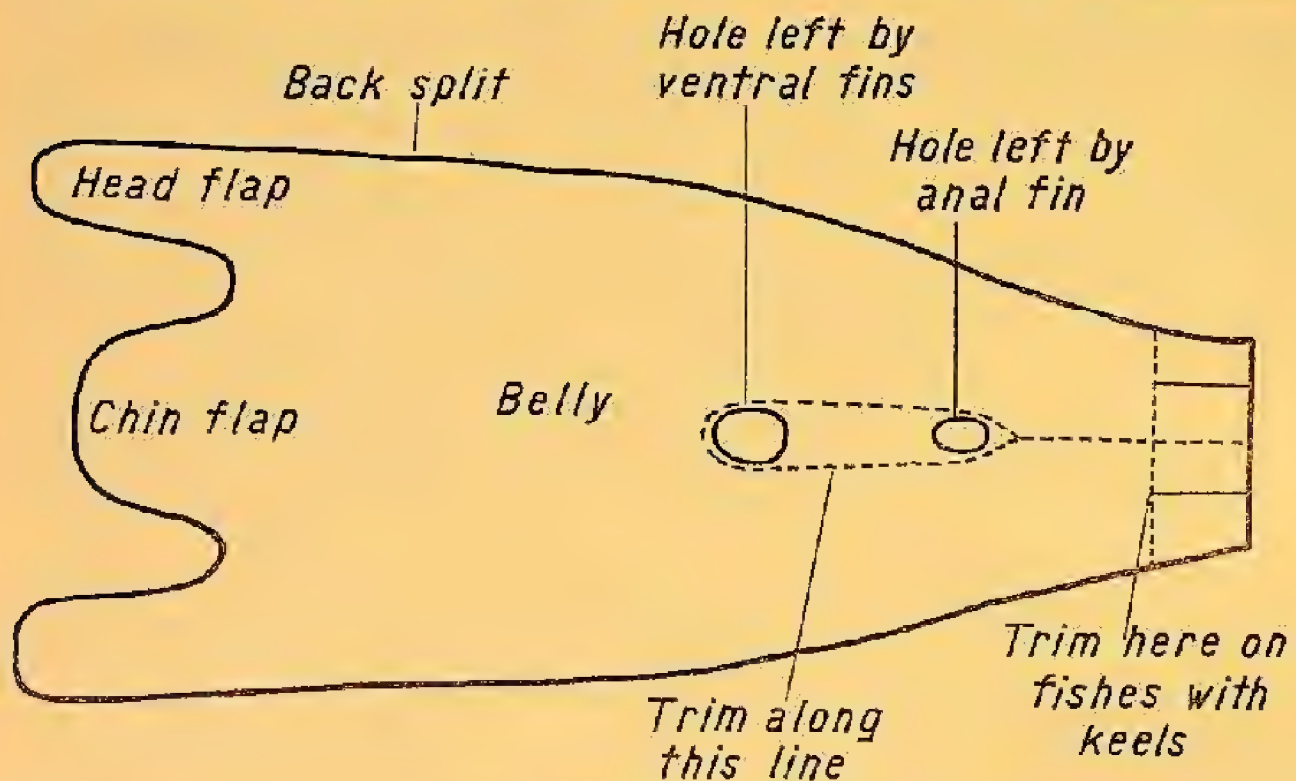


Fig. 59. Diagram showing the hide after being stripped from the shark. From a bulletin issued by the Ocean Leather Company.

manner as before. The left hand should always keep the hide pulled tight while skinning in order to avoid cutting holes in the skin. After the hide is removed, it must be washed thoroughly in sea water to remove all the blood and slime.

Fleshing the Hide

The next operation is to remove all the surplus flesh. This is done with a beaming knife on a beaming board. The beaming knife is a large curved knife with a handle on each end. The beaming board is a surface curved to correspond with the curve of the beaming knife, about 6 feet long and about 3½ feet wide. One end rests on the floor, the other having a support about the height of a man's waist. The board must be perfectly smooth, and it is important never to permit particles of meat or other substance to get between the board and the hide. In fleshing, the hide must be kept smooth on the board.

If the hides can not be fleshed at once, they should be put in brine immediately, where they may be kept not longer than 12 hours, and preferably not more than two or three hours. The brine should be strong enough to float a potato about 4 inches long.

Trimming the Hide

After fleshing, while the hide is still on the beaming board, it should be trimmed. The outer edges, the sharp corners and the small meat particles which may hang over after fleshing, should be cut off. The hide must be split in the tail end by cutting from the hole left by the ventral fin, straight back to where the tail has been cut off, passing through the hole left by the anal fin. (See Fig. 60.) If the shark has keels on the caudal peduncle, these should be cut off. After the fleshing and trimming, the hides must be thoroughly washed in sea water to remove all blood, slime, dirt and clinging flesh. No blood or slime should remain on the hides. They should then be salted for curing.



Fig. 60. The hide after being trimmed. From a bulletin issued by the Ocean Leather Company.

Curing

The curing is done in the following manner: Sprinkle plenty of medium grain fishery salt on the platform or floor where the hides will be laid. Then, after laying one hide out flat, flesh side up, taking care to smooth out the wrinkles, sprinkle salt so as to cover liberally every part of the surface. On top of this hide put the next one, flesh side up, and salt in the same manner, and so on. It is preferable to lay the hides on a platform which has a slight incline, which will permit the water and brine to run off. The pile of hides should be built up as evenly as possible, without any lumps or depressions, and kept well-salted. Large hides take about eight days to cure in this salt pile; small hides about five or six days. While curing, the hides must not be exposed to the sun or come in contact with rain or other fresh water.

Before the hides are packed for shipment, they should be measured. This is done by folding lengthwise, and measuring from tip to tip.

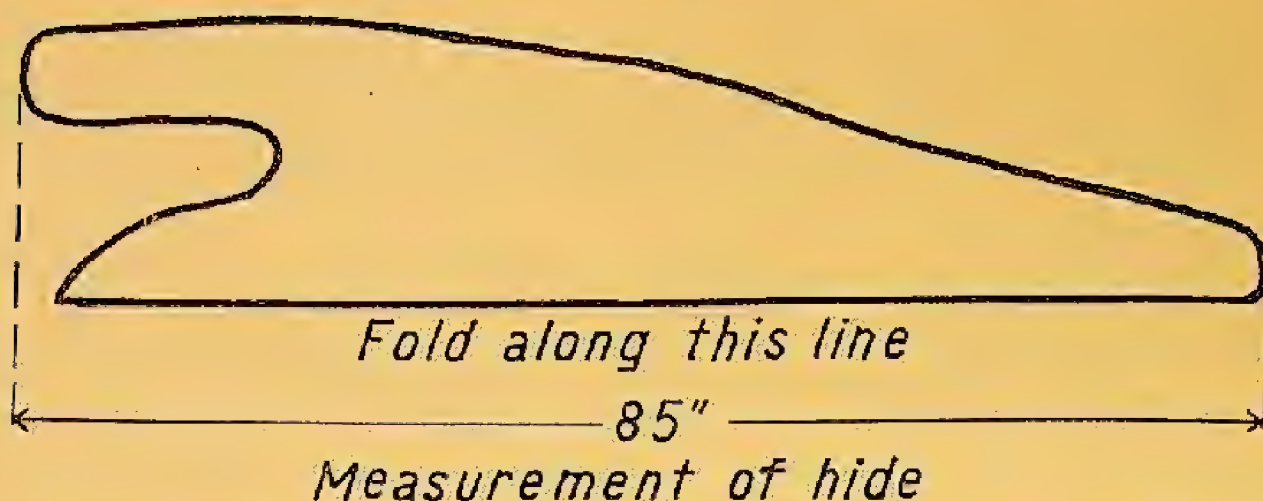


Fig. 61. Showing how to measure the hide in estimating its value. From a bulletin issued by the Ocean Leather Company.

Packing for Shipment

The hides are prepared for shipment in the following manner: After shaking each piece lightly to remove the surplus salt, lay it on the floor, flesh side up, sprinkle the entire surface with dry salt, and fold so as to make it a flat square bundle. Because of possible leakage of brine en route, some transportation companies require the hides to be packed in water-tight barrels. A 55-gallon barrel will hold about 25 average-sized shark skins. The weight will be about 275 pounds net.

After the hides reach the factory, they are tanned, the shagreen is removed and they are colored and finished.⁴

SHARKS FOR THE MANUFACTURE OF FISH MEAL

Despite the number of sharks which fishermen catch incidentally, at only three ports—San Diego, Monterey and San Francisco—were sharks sold to reduction factories in past years, and then in relatively small quantities, merely the incidental catches of fishermen. At these places the sharks were mixed with the fish offal of canneries and from markets and manufactured into fertilizer. Fishermen received around \$5 a ton for the sharks.

SHARK LIVER OIL

The livers of many sharks and rays have a very high oil content. The most important use for this oil is for the curing of leather in the shark industry. The more highly unsaturated oils are used in making tarpaulins and other oiled cloths. Sometimes they are used in the manufacture of low grade soaps, in the tempering of steel, and sometimes are mixed with vegetable paint oils. In Greenland, because petroleum is not permitted in the houses owing to the danger of fire, shark oil is used for illuminating purposes. In Europe, parts of Asia, and sometimes in the United States, shark liver oil is sold as a substitute for cod liver oil. Since different sharks produce different grades of oil, it is necessary to analyze chemically the product derived from each species in order to be able to compare it with cod liver oil. Although it has already been demonstrated that the oil from the liver

⁴ For a description of these processes, see Tressler, *op. cit.*, pp. 495-499.

of the basking shark is not particularly rich in vitamins, it is claimed by some people to have medicinal properties of its own. Perhaps the vitamins are present in the livers but are broken down during the extraction, and possibly improved methods will preserve them.

SHARK FISHING METHODS ON THE EAST COAST

It is evident that if one plans to make a business exclusively of shark fishing, he must not only utilize every part of the shark but he must develop highly specialized methods for catching his material. On the east coast, two methods are employed: Long lines and gill nets.

Long Lines

A line of hemp rope of suitable length, say 500 yards,⁵ is buoyed up at intervals with kegs. At each interval of about 12 or 14 feet, a ganging line provided with wire leader and baited hook is attached. The line must be tended regularly by a boat prepared to kill and haul aboard the shark as soon as it bites. A shark caught on a hook is likely to be attacked by other sharks and destroyed.

Gill Nets ⁶

These are usually 200 yards long, when hung, and about 15 meshes deep. The webbing is made of number 72 medium cotton twine, the meshes being from 7 to 12 inches when stretched. The cork and lead lines are seven-sixteenths of an inch, steam-tarred manila rope. The corks are English net corks, 4 inches in diameter, and are placed after every third mesh.

These nets are set on the bottom, weighted with 50-pound galvanized stock anchors, with about 10 fathoms of anchor ropes, at least three-fourths of an inch in diameter. A small buoy is fastened to one anchor; a flag buoy as a marker to the other. The net itself should also have a small buoy on each end. The length of the buoy ropes, which are of the same material as the lines on the net, depends on the depth of the water where the net is to be set. It is always better to have the

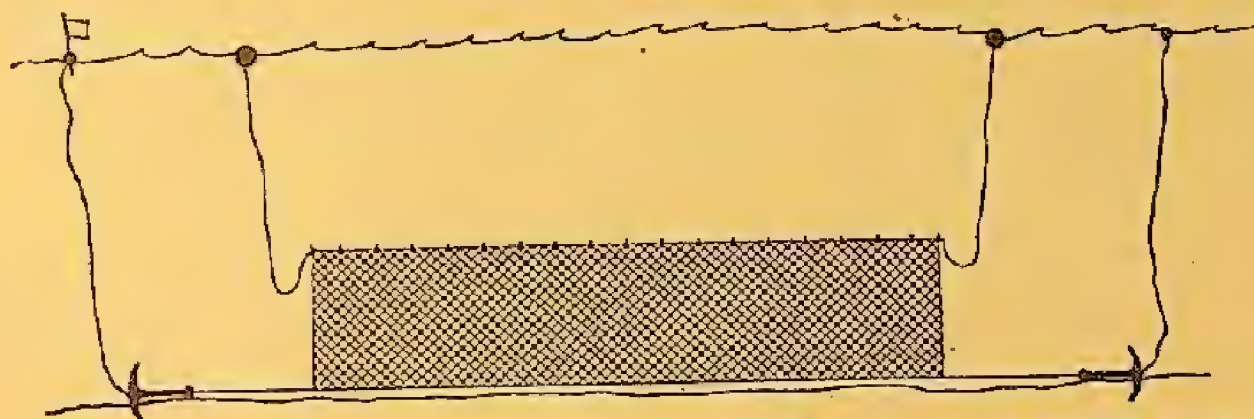


Fig. 62. Diagram showing special type of net used to catch sharks on the Atlantic Coast. From a bulletin issued by the Ocean Leather Company.

buoy ropes a little longer than absolutely necessary. In order to hoist sharks out of the nets, it is advisable to use a large steel hook with an eye or handle.

⁵ From the Fishing Gazette, New York, November, 1923.

⁶ Information supplied by the Ocean Leather Company, Newark, New Jersey.

SHARK FISHING METHODS IN CALIFORNIA

In this State, sharks are taken with hook and line, with set and long lines, and in all kinds of nets. They are a pest to gill net fishermen, as they swim into the nets, thrash about in trying to extricate themselves, roll up, and often cause great damage to the nets, besides occasioning much loss of time to the fishermen who can remove them only with difficulty.

Because of the strain on our other fish populations, as well as because of the damage done by sharks to nets, it would seem to be to the fishermen's interest to attempt to develop a greater shark fishery, if only to relieve the strain and to cut down the shark population. Whether special fishing methods can overcome the difficulty in obtaining enough material to work with sufficiently to support a special fishery remains for some enterprising pioneer to discover. Meanwhile, there is no reason why a fuller use should not be made of the many sharks now incidentally taken and wastefully destroyed.

IN DEFENSE OF PELICANS

By BEN H. THOMPSON

SOME TIME AGO, in the course of office routine, George Neale's article entitled "The White Pelican," in CALIFORNIA FISH AND GAME, volume 18, number 4, pp. 339-341, came to my desk and temporarily disturbed my peace of mind, but, reflecting that each has a right to his own opinions, I consigned that particular issue to the files. Many subsequent references to this article, however, have led to a reconsideration of the matter and to the decision to make my reactions articulate.

Upon picking up this issue of CALIFORNIA FISH AND GAME, the first thing which struck my eye was the slogan, "Conservation of Wild Life Through Education"—rather a good slogan, I think. Perhaps that end can be attained only if each one contributes his parcel of truth. It is, therefore, with this purpose in mind that the following comments are offered concerning Neale's point of view:

1. "Of all the predatory birds and animals that prey upon fish life, the white pelican is the worst of all." (Neale, 1932, p. 339.)

To deny this statement at the outset would, like the statement itself, beg the question. This point will be referred to later.

2. "He (the white pelican) feeds entirely in fresh water . . ." (Neale, 1932, p. 339.)

There are only four places in the United States at present where white pelican breeding colonies of any size exist. These are: Clear Lake, California; Pyramid Lake, Nevada; Great Salt Lake, Utah; and Chase Lake, North Dakota. Of these four major breeding colonies, three are in saline or brinish lakes. Manito, Many Island, Redberry

and Quill lakes in Saskatchewan, Beaver Hill Lake in Alberta, and Shoal Lake in Manitoba, are all alkaline lakes where white pelicans do nest or have nested. There are doubtless other brinish lakes used as breeding areas by the white pelican, although I do not have at hand further data on the subject. It is perfectly true that the pelicans do not fish in many of these lakes, for the reason that these waters do not support fish life. But in Salton Sea, Pyramid Lake, and Beaver Hill Lake (saline lakes which do support fish) white pelicans are as much at home as on any body of fresh water, and they consume the fishes of these brinish lakes.

For several years a colony of white pelicans has nested in Laguna de la Madre on the Texas coast about 30 miles south of Corpus Christi. In 1930 there were at least 5000 adult breeding birds in the colony (Carroll, 1930, p. 304). These catch their fish in the salt water of the lagoon and, of course, every winter practically the entire white pelican population of North America migrates to the Gulf of Mexico, the coasts of Mexico, the Gulf of California, and the coast of southern California, where the winter months of each year are spent on ocean, or salt water.

From the foregoing brief notes relative to distribution, it is evident that the white pelican is not strictly a fresh water feeder, but fishes indiscriminately in both salt and fresh water; in other words, the white pelican fishes wherever it can catch fish by its surface feeding method, regardless of whether the water is fresh or salty.

3. ". . . one pelican can, and does eat more fish per day than would supply a large family . . ." (Neale, 1932, p. 339.)

Much has been written about the quantity of fish which a white pelican consumes in a day. The figures are sometimes appalling. Unfortunately, perhaps, not so much has been written about the appalling number of fishes there are in the world! It is characteristic of these appalling fishes that they produce an appalling number of young fishes which, if they all lived and their progeny all lived, would soon overrun the aqueous portions of the earth and undoubtedly litter the banks, but it is the scheme of things that not all the fishes produced shall reach maturity, for which we should be thankful. Should we then consider these fortuitous adjustments of nature as an economic loss? It seems that we should not count as loss that which we can not use. To be more definite, many kinds of fish are not considered edible by man, but are consumed in large quantity by pelicans and other fish-eating birds. Now if a statement of any significance is to be made concerning the economic losses wrought by the white pelican, it would have to be made in some such fashion as the following: The white pelican consumes blank pounds of game or commercial fish per day, which pelican-consumed fish are taken in direct competition with the hooks and nets of anglers and commercial fishermen, and, all other factors being definitely known and inoperative, and the present reduction in catch of the angler and commercial fishermen being in direct proportion to the fish consumption of the white pelican, it therefore follows that the fish which the white pelican eats are a direct loss to humanity.

I am not denying that this condition may exist at some times in some places, but I have not yet seen a statement to this effect with the facts brought forth to substantiate it.

To return to Neale's statement that "one pelican can, and does eat more fish per day than would supply a large family," may these two things be said:

(a) These fish have not yet been caught; they are not on anybody's hook and line.

(b) Is it certain that these fish which the pelican consumes would be utilized to feed a human family if the pelican did not eat them?

4. "His pouch and maw will hold several pounds of fish which he will carry to the nesting grounds . . ." (Neale, 1932, p. 340.)

I have never heard of a white pelican carrying fish in its pouch. So far as I know, when a fish is caught by a white pelican the fish is swallowed. When the young pelicans are fed, the adult pelican regurgitates the fish, which the young pelican may then procure from the adult's pouch.

5. "As soon as the sun appears, they leave the nest and let the sun do the rest . . ." (Neale, 1932, p. 340.)

Neale here refers to incubation of the eggs. Gromme, however, (Gromme, 1930, pp. 281-282) gives a detailed account of the daily activities of adult white pelicans on the nest. He says:

"Both adults take turns at incubating the eggs. . . The relief at the nest of one parent bird by the other is accompanied by a pretty ceremony. At about 11 o'clock in the morning the relieving bird salutes its mate by a series of neck writhing contortions and bows and whetting of bills. These motions are accompanied by a series of pig-like grunts. This ceremony over, the relieving bird turns with its bill the eggs and cautiously steps between them before tucking them beneath its breast and finally settling down.

"During incubation various positions are assumed by the old bird as it quietly broods. . . . Sometimes the head is turned back and the bill tucked under shoulder coverts, but usually the tip of the bill is allowed to rest on the ground. This position is assumed for long periods of time. One adult noted incubated alternately on three different nests. When the owner of the third nest appeared the intruder slipped off without a fuss and went back to its own nest."

Other observers have also recorded seeing pelicans on the nest during the day. At desert lakes, such as Pyramid, Buena Vista and Salton Sea, the daily temperature during the summer months is so great that the young pelicans die if left exposed to the sun's rays too long. Consequently, the adults stand over the young during the heat of the day and the young are thereby protected. Gromme has photographs depicting this phase of pelican activity, and I have also seen it many times. It also seems probable that eggs exposed to the sun too long would be destroyed. In Arizona I have seen hen's eggs neatly coddled on one side by being left exposed to the summer sun for several hours.

6. "Since the reclamation of these wonderful farming lands, made so by overflows from both the Sacramento and Feather rivers, and the wild waterfowl which wintered there, these birds have sought other places in which to nest; their natural home and habitat is Pyramid Lake in the State of Nevada." (Neale, 1932, p. 340.)

Perhaps it would be better to say that "their natural home and habitat" is the western half of North America, from Great Slave Lake in Mackenzie to Salton Sea in southern California and Corpus Christi in Texas. They used to breed in colonies of thousands throughout California from Salton Sea to Lower Klamath Lake. At present, the only white pelican colony in California of any note is at Clear Lake; all other California colonies have been practically destroyed. For the United States as a whole, I have records of 37 white pelican breeding colonies which have been occupied. In 1932, there were four major colonies. Neale's account of the fate of the Lone Tree Island colony is fairly representative of the fate of the other 33 colonies which have dwindled or ceased to exist.

7. "They live upon live fish, frogs and other aquatic beings. When the pelicans beat the fish rescue crew to a pond where thousands of fish, and mostly game fish too, were yesterday, well it's too bad, for they can clean it out as clean as we can with nets." (Neale, 1932, pp. 340-341.)

The questionable point in the above sentence is the statement that the white pelican feeds on game fish mostly. From the very nature of the pelican's habitat one would be led to question this statement. The white pelican fishes wherever it can procure fish by its surface feeding method. It appears to exercise no choice in the type of fish it consumes, but takes whatever comes within reach. Neale himself says, "they are not in the least particular as to specie; catfish or carp are just a delicacy to them." Moreover, the type of water usually selected by the white pelican for its fishing, and the very nature of its surface feeding, would tend to increase the percentage of "trash" or nongame fish in the pelican's diet. This is not an *a priori* principle; it is a statement of what has been found to be true wherever real investigation has been conducted. The white pelican has been found to eat large quantities of carp and suckers, lake chub, lake minnow, quee-wee, brook stickleback, ling, sauger, mullet, salamander and crawfish.

Without going further into the matter here, I should like to sum up my thesis as follows: The white pelican fishes indiscriminately in fresh or salt water. It consumes any fish which its surface feeding method allows, and appears to exercise no choice in the type of fish taken. Many game fish are taken, and at localized areas such as at rearing ponds and some spawning grounds, local damage to game fish may be considerable. On the other hand, what records are available indicate that the greater part of the pelican diet consists of nongame fish, fish considered inferior from human standards, and that many of the fish which the white pelican consumes are fish which prey upon game fish. Inasmuch as there is no known way, at present, of our controlling the "trash" fish which prey upon game fish, the white pelican and other fish-eating birds may be absolutely essential to the control of the undesirable species of fish. We may be faced with the paradox that in order to have more game fish we must have more fish-eating birds. Further investigation of the food habits of the white pelican and the predacious habits of certain fish is needed before the problem can be definitely settled. But enough has been done to show that no one is in a position to make the statement with which Neale opens his article, namely: "Of all the predatory birds and animals that

prey upon fish life the white pelican is the worst of all." For all we now know, the white pelican may be the best of all.

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CALIFORNIA STEELHEAD TROUT PROBLEMS

By A. C. TAFT, Assistant Aquatic Biologist, U. S. Bureau of Fisheries

THE SPORTSMEN OF CALIFORNIA are faced with the problem of deciding what steps shall be taken to maintain and augment the steelhead fishing in the coastal streams. The more accessible streams have for some years shown the effects of heavy fishing and as the number of anglers increases and better motor roads are constructed these depleted streams are, to a large extent, abandoned for others which have previously been inaccessible. The streams from the Gualala south to the Big Sur are remembered by many anglers as furnishing excellent fishing in past years, but today are hardly given serious consideration when a fishing trip is planned. It is true that they all still contain fish in considerable numbers and for the first few days after the opening of the spring season their banks are crowded with anglers who make fair catches. The fact still remains that a good deal of dissatisfaction is expressed over fishing conditions in these streams, and it will probably clarify the problem considerably if an analysis is made of the causes for this dissatisfaction and the reasons for its existence.

In order to discuss adequately these problems it will be necessary to refer frequently to the facts which we now know regarding the life habits of the steelhead trout. It will be well to acknowledge at the start that there are a great many things that we do not know that are essential if we are to take advantage of their natural characteristics to increase their number and provide better fishing. These gaps in our knowledge will be referred to in connection with the discussion of the causes of depletion.

At the very start we are handicapped by the fact that we do not know just what a steelhead trout is and how it differs, if at all, from the so-called rainbow trout. This question as to the difference between rainbow and steelhead has been under discussion for a good many years and has not yet been satisfactorily settled. It is now fairly well agreed that the two fishes do not differ sufficiently in form or structure to be separated by the usual characters of this kind that differentiate species. The trout are very variable in most of their bodily characters and coloration and for that reason there is a great tendency to separate different types under different names. Everyone is familiar with

the fact that steelhead fresh from the ocean are bright and silvery and do not greatly resemble the ordinary stream-caught fish. Aside from all differences of appearance, the chief characteristic of steelhead in which we are interested from a practical standpoint is their habit of migrating from fresh water to the ocean when young and returning at maturity to spawn. In fact that is the only clear cut character that we have for use in defining just what we mean by the term steelhead. In other words, an adult steelhead is a trout that has spent part of its life in the ocean and as a consequence has attained a greater size than the ordinary stream fish. Young steelhead are the offspring of these fish which have returned from the ocean and steelhead streams are those in which the great majority of the spawning fish are of this type. The necessity for this broad generalization lies in the fact that in a great many steelhead streams trout have been found that have reached maturity without ever leaving the stream. These fish were apparently more numerous in the past than they are today. Whatever the reasons for this may be, the important point to consider is that we do not know whether or not these fish differ from the ordinary sea-run fish. It may be that fish hatched from the eggs of these resident fish become migratory steelhead just as readily as though their parents had been of this latter type.

The great majority of the fish in our coastal streams are, however, migratory, and their life history is, in brief, as follows: The adult steelhead return to the streams from the ocean during the months from August to May, although the time of the run varies from stream to stream. In the larger rivers such as the Klamath and the Eel, where the mouth is usually open, the run is earlier than in the smaller streams where the mouths are closed except at the time of freshets and the fish must of necessity enter after the heavy rains of December, January, and February. Some of the fish travel to the very headwaters to spawn and are often found above falls and log jams that are a complete barrier to the ascent of silver salmon. By the end of May spawning is completed and by this time the fish from the earlier eggs have come out of the gravel.

Apparently all of the young trout stay in the streams during the first year. During the following months, and particularly during the winter and spring, some of these young fish move downstream into the lagoons and a few of them go on out to the ocean after spending the greater part of their first year in fresh water, but the greater number remain in the stream and by the opening of the season on May 1st many of them are four inches or more in length. As will be shown later these fish furnish the bulk of the catches at the opening of the season.

Most of the young steelhead leave the stream during the following winter and spring, when they are about two years old. There are a number of fish, however, that remain over until their third year, but very few stay in the stream after that time.

During the first year in the ocean the young fish grow very rapidly and some of them, particularly the males, return to spawn after a single summer of sea feeding. The balance of the males and most of the females remain a second year in the ocean before returning to spawn for the first time.

After spawning the fish return to the ocean when possible. Very often they are trapped by the receding water and may remain in the stream all summer. Some of the fish also die from various causes after spawning but those that have escaped the anglers return to the sea where they renew their strength by heavy feeding. Some of the females are known to have spawned as many as five times, but such fish are relatively rare.

Aside from the habits of the steelhead the character of the streams in which they live is the chief factor which must be considered in a study of their abundance. We may assume that originally practically all of the streams from the Oregon line to Monterey were favorable for the propagation of these fish, as they are known to have inhabited them in considerable numbers. It is equally fair to assume that the changes that have been wrought in these streams since the settlement of the State may have had a part in the reduction in their numbers.

If only the principal streams and their larger tributaries are considered it will be found that, exclusive of the Sacramento-San Joaquin system and the streams south of the Big Sur, there are some 5000 miles of stream in the coastal area, and if the creeks down to three miles in length are included the total will be enormously increased; in fact, we shall then find that there is as much as 5000 miles in the Klamath system alone.

All of these streams lie entirely or in part within the coast redwood belt which has been almost entirely logged off. It is difficult to estimate what effects this deforestation may have had on the fish life, but we do know rather definitely that it has made some changes in the streams.

In the first place, the fluctuations in the flow have been greatly accentuated. This means that the floods of the rainy season are more violent and destructive and that subsequently the summer flow is reduced to the point where many of the smaller streams dry up completely. Some of the larger streams are reduced to isolated pools which are fed by the flow of water through intervening gravel beds. The surprising thing is that if not fished out most of these half-dry streams successfully carry young steelhead through the summer. In several instances it has been found that the beds of the streams have also been changed by the washing in of silt and fine gravel which has covered up former spawning beds.

The Klamath, Eel, and the streams to the south of San Francisco have been, in addition to deforestation, seriously affected by the construction of dams and the diversion of water for irrigation and power. This has two effects on the fish. Spawning grounds are cut off or destroyed by the construction of the dams, and secondly, many small fish are destroyed when carried out on to the land with the diverted water. This loss of small fish is to some extent preventable, but only with considerable difficulty.

In spite of these factors, which may have played a part in reducing the number of fish in the streams, the fact remains that angling has probably played a greater part than any other one thing. Few realize the number of fish that have been taken and are still being taken from the steelhead streams.

Even in streams such as the San Lorenzo, which has been fished for years, the number taken is still very great, but the total is lost sight

of due to the fact that the number of anglers has greatly increased and consequently the number of fish taken per individual may be small. Unfortunately, we do not have any very satisfactory figures on the number of fish taken, either per angler or per mile of stream. In two cases we have estimates that have been based on close observation, where the number of fishermen could be obtained with fair accuracy. In the first instance a small stream in Santa Cruz County, with about 12 miles of fishing water and a flow of about one second-foot at low water, is credited with a catch of 25,000 fish in 1928. In the second case it is estimated by a deputy that in a Mendocino County stream over 100,000 fish were taken in a single year. This stream is about 20 miles in length and as it is reached by a logging railroad it is possible to get a fair check on the number of fishermen and their creels. As will be shown later these were, for the most part, very small fish.

These figures may appear extravagant but they are borne out by seining which we have done in some of the smaller streams in the course of cooperative trout investigations conducted by the U. S. Bureau of Fisheries and the California Division of Fish and Game. On October 1, 1931, a seine haul was made in the Garcia River just above the junction of the North Fork. The pool was about 70 by 20 feet and 2½ feet deep. In this haul 323 trout and 34 silver salmon were taken. On the same date a haul was made in Alder Creek about one mile from the mouth. This pool was about 100 by 20 feet and 4 to 6 inches deep; 282 trout and no salmon were taken. On September 22, 1932, two short hauls at the Miners Bend in the Gualala River gave 210 trout. In all of these cases it was apparent from the size of the fish that most of them were in their first year. Although the seining was done at the time of low water and the fish were to some extent concentrated in the pools there was in all cases sufficient flow of water to enable them to move up and down stream, and they were as plentiful in neighboring pools as in the ones that were seined.

As has already been stated, most of the trout leave the steelhead streams before they reach three years of age. It naturally follows that most of these immature fish that are caught during the summer season are very small. In order to obtain data on the size of these fish caught by the anglers, cards were sent to all of the deputies in the coastal districts before the opening of the season in 1932. On these cards they were asked to report the number and sizes of the trout and salmon taken. One of these cards was made out for each creel checked and the results are shown in the following table:

<i>Length in inches</i>	<i>Number of trout</i>	<i>Per cent</i>	<i>Number of salmon</i>	<i>Per cent</i>
3-4	41	3.8	142	57.3
4-5	548	50.8	104	41.9
5-6	380	35.2	2	.8
6-8	90	8.3		
8-10	14	1.3		
Over 10	6	.6		
Total	1079		248	

This report includes fish taken from streams all the way from Monterey County to Humboldt County and two things are at once made apparent. The first is that most of the trout taken are fish which are under five inches in length and are probably just starting

their second year. The second is that a considerable number of very small silver salmon are taken as trout. At this size the average angler does not distinguish the trout from the salmon. As far as age is concerned it is probable that the fish from 3 to 5 inches in length are in their second year while those from 5 to 8 inches are in their third year. Practically all of the fish over 10 inches in length were reported as mature spawned out fish which had not yet returned to the ocean.

These small fish are the ones that are caught in the coastal streams in great numbers during the summer months and they are at the same time the stock from which the large mature steelhead are derived. We do not know exactly how many of these young fish must be allowed to migrate to the ocean in order to provide for the return of one adult but judging from experience elsewhere the number probably varies from four to ten. In other words, for every mature steelhead, four to ten young fish must be allowed to grow in the stream until they are ready to migrate. It is certain that if the present drain on these young fish continues, there will not be enough adult fish returning to the streams to make good fishing. At present the season opens in May and continues to November, with a daily limit of 25 trout or 10 pounds and one trout, and no size limit. From November through to February the limit is three trout regardless of weight. This leaves March and April as the only closed months in most of the coastal streams.

In the taking of these small trout during the summer months arises one of the greatest dissatisfactions with angling in the coastal streams. The complaint, common enough among anglers, that the fish are too small, is particularly well justified in this case. The reports of the deputies showed how pitifully small most of the fish are and as a result most of the anglers strive for a limit as being the sole measure of accomplishment.

This taking of immature steelhead in turn gives rise to the second complaint, which is that the catch of mature steelhead has decreased alarmingly in certain streams. Although the curtailment of the number of young fish taken would be an important step towards increasing the number of adult fish returning to the streams, some steps should be taken to increase the protection given the adult fish after they have run the gauntlet of anglers in tidewater and the main stream, and have reached the spawning grounds in the smaller tributaries.

A great many proposals have been made for improving the steelhead fishing and it may be well to review them in the light of the foregoing statements. The most frequent proposal is to plant more hatchery reared fish. There are now six hatcheries supplying the streams in the coastal area. As we have seen this means about 1000 miles of stream for each hatchery to serve if they are all to be stocked, and also means that at present each hatchery is expected to serve a greater area than can be accomplished satisfactorily if the present number of fish is to be maintained. Instead of leaving the hatcheries free to concentrate their output in certain areas where the need is very great due to a concentration of anglers or the construction of dams, they are forced to spread their efforts over such a wide area that the effect is partially lost. Under present conditions the construction of more hatcheries is hardly possible as barely enough money is available to run those now in existence. Up to the present time the hatch-

eries have concentrated their work to a considerable extent, but as an increasing number of streams become depleted they are expected to extend their work to these new streams that have previously been self-maintaining. This merely means that the same number of fish is spread over a larger area with considerable loss in effectiveness. The hatcheries should be given every possible assistance as their task is a difficult one. Few sportsmen realize the enormous number of fish it takes to make satisfactory angling in the aggregate.

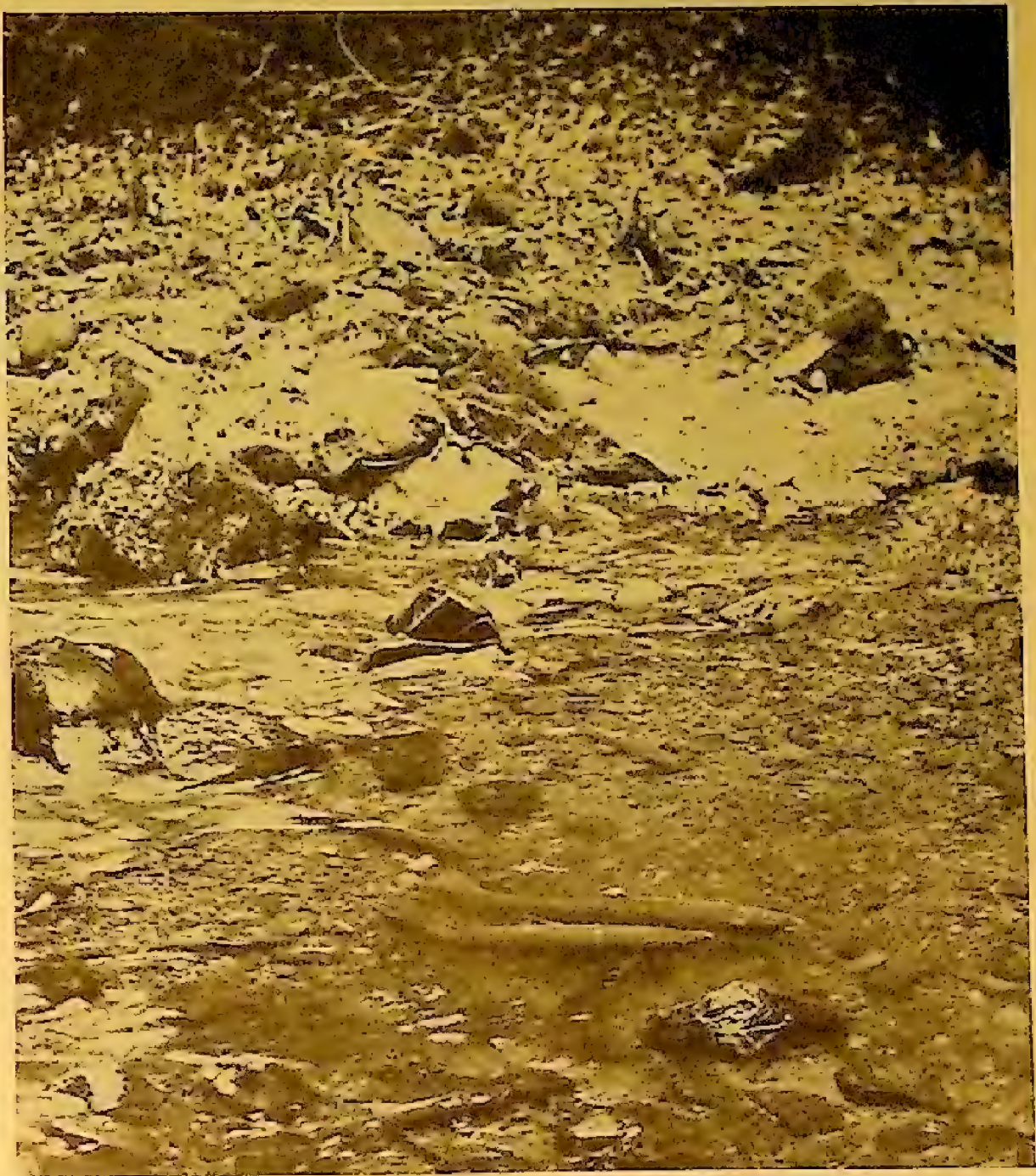


Fig. 63. A pair of steelheads over the spawning nest and three small males nearby. Photograph by Dr. P. R. Needham.

A size limit has at times been suggested as a means of protection. As we have seen that only 10 per cent of the fish examined by the deputies were over six inches in length, it is apparent that the imposition of a size limit would amount to an indirect closure of the streams and would probably give rise to considerable difficulties in enforcement and a loss of small fish that would die after being returned to the stream.

The introduction of other species of trout has been suggested as a means of improving the fishing in the steelhead streams. This suggestion is based on an acknowledgment of the fact that for the most part the young steelhead are too small to furnish satisfactory angling. The intention in introducing these fish would be to have a nonmigratory form that would furnish larger fish in the stream during the months when the adult steelhead were not running. There are two objections to be brought against such a plan. The first is that it is doubtful if a resident species could be maintained along with the young steelhead without endangering the maintenance of the latter. The probable result would be very mediocre fishing for both species. This has been the result in the Russian River where the introduced brown trout have by no means taken the place of the once abundant steelhead. As a matter of fact most of the coastal steelhead streams become so low



Fig. 64. Steelhead jumping at the Benbow Dam, Eel River. Photograph by A. C. Taft.

and warm during the summer that it is doubtful if large trout of any sort would thrive in them.

One of the great advantages that accrues to California from the steelhead comes from the fact that the fishing for the adults offers sport when the Sierra streams can not be reached. Would it be wise then to take a chance on exchanging one of the best kinds of fishing during the winter months for a duplication of the type of fishing that is now obtainable in thousands of miles of mountain streams? California has sufficient stream mileage so that the State could well afford to abandon entirely summer fishing in the coastal streams and instead use these waters to provide a fine type of trout fishing during the winter months when the Sierra streams are closed.

Shortening the summer season would only be partially effective in protecting the young stream fish for the reason that the number of fish taken is not always dependent upon the length of the season. In a great many cases the shortened season merely means a greater concentration of fishing within the shortened period.

Probably the most effective protection is furnished by the complete closure of certain portions of the streams or of tributaries that are important nursery grounds. During the past year this type of protection was initiated in certain of the coastal streams by the Division of Fish and Game. In these cases the lagoons were closed to all fishing during the summer months. These lagoons are great natural nurseries for young trout as food is very abundant and they make a more rapid growth than in the stream. This closure of the lagoons is a step in the right direction and could profitably be extended to include larger portions of the streams.

In the case of the Klamath and Eel rivers, the situation is slightly different. There, certain tributaries that are known to be favorable spawning grounds should be set aside as nursery streams and permanently closed to fishing. Everyone is thoroughly familiar with the idea of game refuges and the necessity for them, but the trout are expected to remain abundant with little or no protection.

The question might reasonably be raised as to the necessity for further restriction when the fish are as abundant as they have been shown to be in the foregoing paragraphs. The alternative is largely one of large fish or small fish. If the present fishing is continued decreasing numbers of these fingerlings will be taken for several years to come. They are very easy to catch and as fishing increases fewer of them will be left to reach maturity and maintain the stock. On the other hand if the emphasis is put on the fishing for the adults the fishing will not only be improved but will result in more pounds of fish and greater satisfaction for the sportsmen of the State.

CONDITION OF THE YELLOWTAIL FISHERY¹

By S. S. WHITEHEAD

INTRODUCTION

SINCE YELLOWTAIL (*Seriola dorsalis*) is of interest to both the commercial and sport fishermen, the authorities of the California Division of Fish and Game ordered an investigation of the fishery to determine whether or not the species is in need of protection. A preliminary survey was made of the fishery at San Pedro, and the number of catches made in a season were found to be too scanty for a detailed study of individual boat catches. The small total annual catch was delivered in a few relatively large amounts by boats using purse seines, but only a very few catches are represented in each season during the last few years. On the other hand the data at San Diego were ideal for a study of boat catches because the fishery was exploited by small live bait boats which made daily catches over a period of at least four or five months in a season. Since the data for the San Diego fishery were much more adequate, the study of the yellowtail boat

¹ Contribution No. 130 from the California State Fisheries Laboratory, June, 1933.

catches was made for this region only. In order to draw logical conclusions and use the data efficiently, it was necessary to know the fishing methods of the boats engaged in this fishery.

FISHING METHODS

Small fishing boats, 60 feet long or less, are used exclusively in this fishery, as the fishing grounds in the San Diego region are local, being between Point Loma and La Jolla. When fishing for yellowtail and barracuda, fishermen install on the stern of the boat a live bait tank in which small sardines are kept alive for use as bait. Three to six hundred pounds of live bait are used by each of these boats every fishing day. The bait is caught between midnight and daybreak with a small lampara bait net. Most of the young sardines (quarter-oil size) are often caught at the mouth of the San Diego harbor and off Coronado Beach.

After enough bait is caught, the boats cruise to the fishing grounds and start fishing at about daybreak. The localities commonly fished

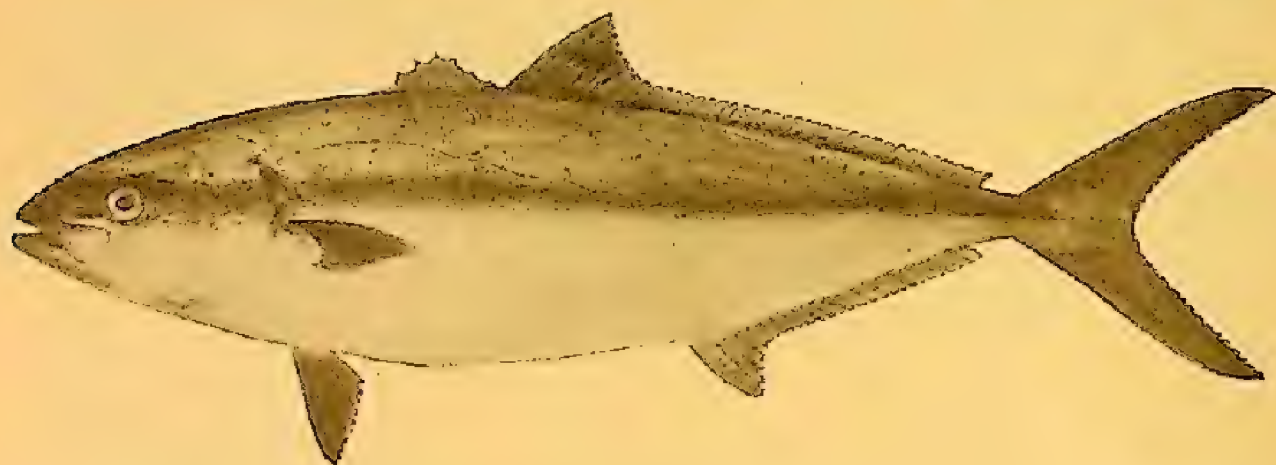


Fig. 65. Yellowtail (*Seriola dorsalis*)

are in the kelp beds from Point Loma to La Jolla, although when yellowtail are scarce in this region the boats go as far north as Ocean-side. When the grounds are reached and fish are located, one of the fishermen throws a few live sardines into the water to attract the school of fish near the boat. This is called "chumming." Each of the men on the boat baits his hook with a live sardine by inserting the hook in the cartilage of the snout. (This does not injure the fish.) The sardines swim around vigorously for about five minutes before gradually quieting down and becoming ineffective bait. Fifteen to eighteen feet of line is generally used to allow the bait to swim around naturally.

Fishing is carried on between daybreak and noon, and then the boats go to the San Diego fresh fish markets to sell their catch. Yellowtail and barracuda comprise the bulk of the catch, with small amounts of mackerel, white sea-bass and rock bass contributing slightly. Sometimes yellowtail and barracuda school separately, while at other times they school together and are therefore caught simultaneously. The same method of fishing seems equally effective for catching one species

as the other. The main reason for the success or failure of catching one species or another is due to the numbers of fish of each species available to the fishermen. Since the fishermen fish for both species, the barracuda catches were also analyzed in this study of the yellowtail.

ANALYSIS OF BOAT CATCHES

After thoroughly examining the catch data for the years from 1922 to 1932, inclusive, all the boats that consistently landed fares of yellowtail and barracuda were listed. The number of boats that made 20 catches or more in each year are shown in the following table:

	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932
No. of boats -----	11	16	19	24	24	24	16	18	18	23	21

Since this analysis is a comparison of fishing success from year to year, the period of time compared should be constant. June is the first month in which consistent fishing occurred year after year. By the end of October most of the boats cease fishing for yellowtail and barracuda. Consequently, the fishing season used in the analysis is from June to October, inclusive.

Each day's catches that are made within this chosen season (June-October) were tabulated by species. An average daily catch per boat for each year was calculated by summing the catches for each year and dividing by the total number of catches. This method of determining the average would be sufficiently accurate if there were no seasonal changes in size of the daily boat catch. In the yellowtail fishery the catches in August, September and October were consistently larger than the catches in June and July. This seasonal fluctuation would unduly affect the comparison of each average daily boat catch for a season. The changes in the sizes of catches in months of large catches would over-shadow or mask the changes in the months of smaller catches.

In order to give the changes in the small sized catches equal weight with fluctuations of the large catches, the averages for each month were compared for the period 1922 to 1932. That is, all the June average boat catches for all seasons were compared and the same comparisons were made for each subsequent month to October, inclusive. Next, all the catches for all Junes were averaged, all the Julys, and so on. These averages were used as bases from which similar months of each season (1922-1932) were compared or the percentage deviations from the base obtained. Logarithms were used in this comparison of each monthly value to its base. In order to calculate the relative size of catch for each season, the deviations for each series of months must be combined into one value for every year. That is, the deviations for July, August, September, and October of 1922 were combined into one value. Each of the years to 1932 were treated in the same manner. The method of combining depends upon factors peculiar to the data from each fishery. In the yellowtail fishery, 70 per cent of the total number of catches fell in the first three months. The size of the catches in June and July was relatively small. If in a season of poor fishing few catches were made in June and July and the catch of each month was weighted by the number of

catches made, the resulting value would be unduly high. This would be caused by a lack of a normal number of small catches in June and July, which would hold the average down for the season. In order to eliminate this discrepancy each month's percentage deviation from the base was weighted by an average number of catches for each corresponding series of months. Each month's weight was determined by computing an average number of catches for all the months of June in the period of 1922 to 1932, likewise for July, August, September and October. The average daily boat catch deviated from the base by months and weighted by a normal number of catches by months is con-

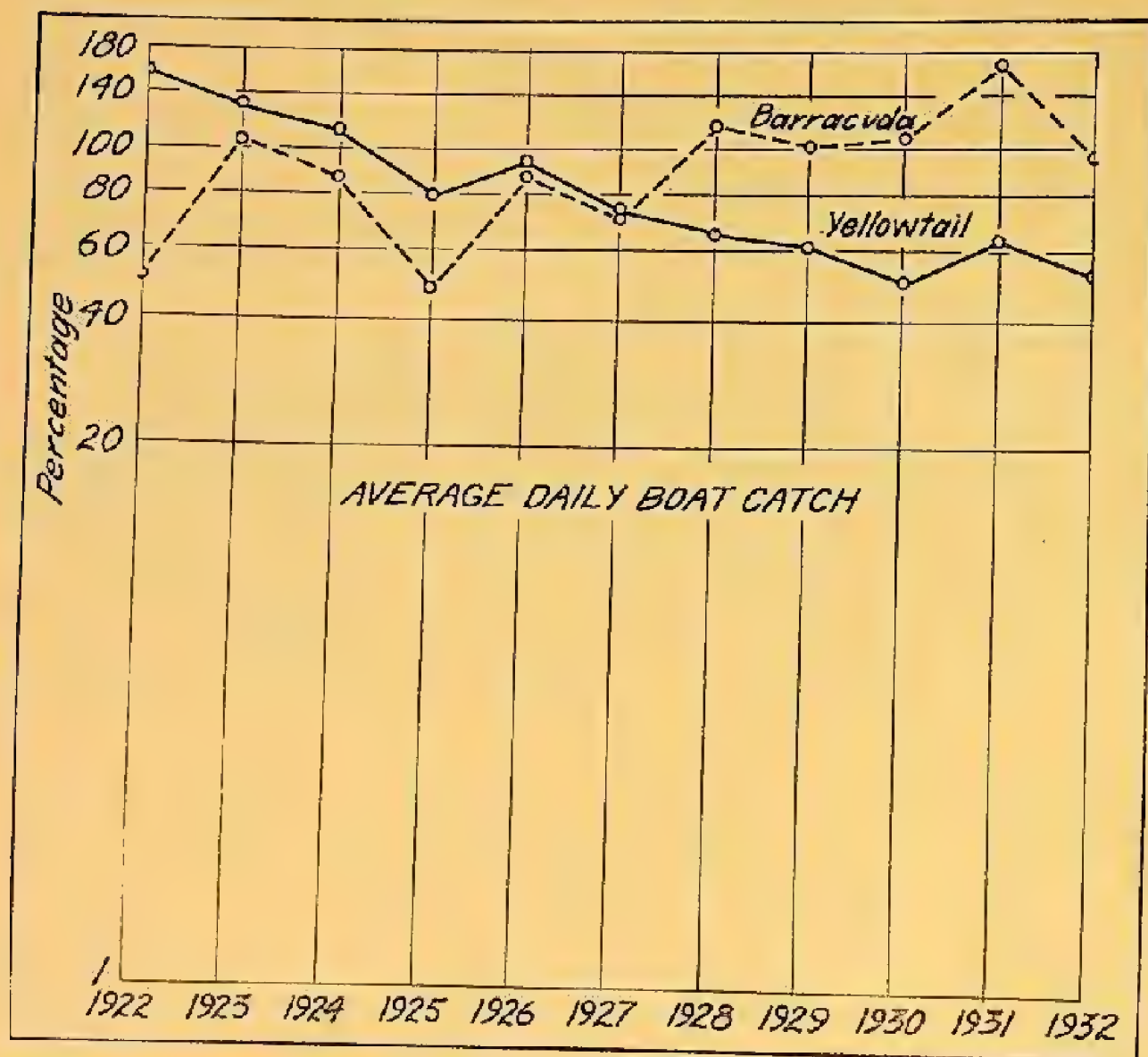


Fig. 66. Comparison of the relative average daily boat catches of yellowtail and barracuda.

sidered to be the best method in analyzing this particular type of data and is shown graphically in figure 66.

Since the barracuda catches were so closely related to the yellowtail, the trend of the average daily boat catches of barracuda is also presented. As can be seen in figure 66 the trend of yellowtail is definitely downward, while that of barracuda is slightly upward. As the increase of barracuda is much less than the decrease of yellowtail, the downward slope should not be attributed to a change in fishing effort from yellowtail to barracuda. The relationship between the amounts of each species available can not be accurately expressed

because it is not known how the abundance of one species affects the catching of another.

CONCLUSIONS

There is no doubt that the great decline in the trend of yellowtail boat catches is due to a decrease in the population of yellowtail available to the fishermen and not to an increase in the abundance of barracuda. The decrease may have been due to a series of poor spawning seasons or a gradual increase in the natural enemies which would deplete the population to an appreciable extent. However, no matter what the cause may be, the yellowtail need all the protection that man can give. Since we have little or no control over its natural enemies and spawning success, the only protection we can give is to curtail the intensity of man's fishing.

In giving legal protection to the yellowtail fishery, there is no reason at the present time why the southern California region, from Santa Barbara to San Diego, can not be considered as one area or district.

FROGS AND THEIR COMMERCIAL USE

By TRACY I. STORER, Professor of Zoology, University of California¹

MANY inquiries concerning the possibilities in rearing frogs for the market have been sent to the University of California, the California Division of Fish and Game, and the California State Department of Agriculture within recent years. To answer these a mimeographed circular on the subject, prepared by the writer, has been distributed widely. Since the number of letters on the subject has been increasing it has seemed desirable to offer a somewhat more detailed statement on the subject. The author has visited numerous places where attempts were being made to rear frogs in captivity, has corresponded with many persons on the subject, has been studying the frogs and other amphibians of western North America for the past 20 years, and has used every opportunity to obtain reliable information upon the subject.

The market demand for frogs rests upon use of the flesh (chiefly the hind legs) as food, and use of the entire animals, either alive or preserved, for scientific study in biological laboratories. Frog legs have always been considered a specialty item, sometimes replacing fish in a menu; their use as food is relatively limited, especially as compared with the quantities of fish consumed as human food. Incidentally the use of frog skins as leather and for glue and the canning of frog meat have been considered.

IMPORTANT SPECIES

There are 17 or more species of frogs native to the United States and Canada, but only a few of these are of commercial value. These are:

¹Contribution from the Division of Zoology, College of Agriculture, University of California, Davis.

AMERICAN BULLFROG (*Rana catesbeiana*) also known as Louisiana frog and jumbo frog. Native to eastern half of North America, from Gulf coast to southern Canada and west to Texas, Kansas, and Wisconsin; acclimatized in California, Oregon, Washington, and Idaho, and possibly in other western States; and also established in Hawaii and Japan. Present in California at least from near Colusa and Biggs in the Sacramento Valley south to Stanislaus River in San Joaquin Valley; also in Sonoma, Santa Clara, and Santa Barbara counties and in Los Angeles and Riverside counties. Reported to have been planted about Lake Tahoe. Head-and-body length 6 to 7 (exceptionally 8) inches; large adults weigh over one pound. Upper surface green with more or less brown over color, sometimes in distinct spots; undersurface white or pale yellow; back practically smooth, no longitudinal folds; ear



FIG. 67. Eastern Bullfrog. (*Rana catesbeiana* Shaw.) Adult male from El Verano, Sonoma County, California, two-thirds natural size.

membrane large, equaling eye (females) or exceeding eye (males) in diameter. Strictly aquatic, inhabiting only permanent bodies of water; larvae require two (or one) years from egg to transformation.

GREEN FROG (*Rana clamitans*). Eastern North America from southern Canada to Florida, west to Michigan, Illinois and Arkansas; unconfirmed reports of this species in California. Smaller, but similar in appearance to bullfrog; throat yellow; average length of adults under 3 inches; habits in general those of the larger species.

LEOPARD FROG (*Rana pipiens*). Most widely distributed frog on this continent, ranging from Atlantic seaboard to east side of Sierra Nevada. In California occurs in Surprise Valley, Modoc County, and about Lake Tahoe; also in Imperial Valley. Total length not over 3

inches. A conspicuous longitudinal fold of skin along either side of back; a series of very distinct large oval light-margined dark spots on back. Inhabits damp grassy meadows and marshes.

CALIFORNIA RED-LEGGED FROG (*Rana aurora draytonii*).² Restricted to California (and extreme northern Lower California) west of the Sierra Nevada and southern mountains and south of Mendocino County; length about 4½ inches; underside of the body and hind legs always with more or less salmon red; upper surface of body varying in color from light yellowish brown to blackish brown with scattered irregular black spots each with a light center; ear membrane (behind eye) smooth and always smaller than eye in diameter. Inhabits permanent pools on foothills, streams and reservoirs.

Other species of frogs are used locally as available, but none of them is important in the California trade.



FIG. 68. California Red-legged Frog. (*Rana aurora draytonii* Baird and Girard.) Adult female from near Berkeley, California. Two-thirds natural size.

Edible frogs are often called "French frogs." So far no species of edible foreign frog is known to be established in the United States, despite frequent claims that breeding stock has been imported from abroad. The terms "French frog," "jumbo frog," "Louisiana frog," etc., are often applied to the American bullfrog.

COMMERCIAL USE

No figures are available regarding the quantities of frogs used commercially in California; in fact there are very few reliable statements anywhere concerning the numbers of these animals sold or the prices received, since data on frogs are not ordinarily included in the statistical reports on fisheries compiled by the Federal government or the States. Only a few casual records are at hand. Some years ago one of the principal California dealers handled over 3000 dozen frogs annually, and, at times, had as many as 250 dozen live frogs on hand to supply his customers. But early in 1933 it was reported that more

² "The celebrated jumping frog of Calaveras County," immortalized by Mark Twain's story, was undoubtedly of this species (if indeed the story has any factual basis!), but the recent contests in perpetuation of the incident have featured the larger (but to California alien) Bullfrog!

frogs were offered to San Francisco dealers and restaurateurs by local collectors than could be used by the trade. Only a few of the more select restaurants regularly list frogs on their menus. With an increasing local supply and lower prices for "frog legs" on menus, it is possible that a somewhat larger commercial use of these animals may result in California.

The aggregate numbers of frogs needed for scientific work is moderate; small schools purchase one or more dozen annually, while large institutions may require several hundred frogs each year. Biological supply houses in various parts of the United States, as a part of their regular business, sell live or specially preserved specimens to educational institutions where frogs are used for dissection or in experimental work. Wild-caught frogs are obtained, especially during the earlier months of the year, and distributed as ordered through the summer and winter months.

Inquiry by the U. S. Fish Commission in 1900 indicated that the annual catch of frogs in the United States as a whole was then slightly under one million animals with a gross return to the hunters of about \$50,000 and the cost to consumers not less than \$150,000. In 1908 the Commission reported a total of 250,000 pounds of frog legs with a value of \$42,000 taken by hunting in thirteen eastern states, of the Mississippi Valley and Atlantic Coast. The commercial take of bullfrogs in Louisiana during 1928 was reported as 715,540 pounds valued at \$107,331. In France, Belgium, Switzerland and Germany, there was, at least in earlier years, a considerable demand for frogs during the Lenten season. Incidentally it is reported that the use of frogs for food in France is less than that in the United States.

The prices received by either collectors or dealers for frogs are never large, excepting when large bullfrogs are sold as "breeding stock" to persons enthusiastic about "frog farming." It is reported that large bullfrogs have been sold at \$10 (and exceptionally more) per pair! However, the top retail price quoted for extra large live bullfrogs to be used in biological laboratories within the past decade has been one dollar apiece, or \$9 per dozen. In 1925 the retail price in California for medium-large bullfrogs was \$6 per dozen; smaller frogs (3 inches in head-and-body length) were \$3 per dozen. In 1933 these two size classes were quoted at \$2.50 and \$1.25 per dozen, respectively. Men who collect frogs for the dealers in California were earlier reported to receive about two-thirds of the retail price for their animals. When the frogs reach the restaurant table in the southern and eastern States the customer may pay from 60 to 75 cents per serving, and up to \$1.25 or even more in the west. However, in places where frogs are abundant a dish of "frog legs" may constitute the entree for an entire lunch or dinner costing only 75 cents.

In general, epicures seem to prefer medium-sized frogs. Several persons have stated that the most delectable of all American frogs is the red-legged frog of California. However, the bullfrog is used extensively because of its size, a large individual supplying as much flesh as a small "fryer" chicken. With frogs of small size only the hind legs are used, but the adult bullfrog has enough flesh along the backbone and on the forelegs to warrant use of the entire animal. According to the Louisiana State Department of Conservation a 6-inch

male bullfrog will weigh, alive, about $10\frac{1}{2}$ ounces, and the dressed meat $6\frac{1}{2}$ ounces; a 7-inch frog will weigh 17 ounces and dresses out at 11 ounces.

At present all or practically all of the frogs sold either for table or scientific use or as "breeding stock" are captured in the wild. In past years the supply for California included a few native frogs, but the bulk of the supply, chiefly of leopard frogs and bullfrogs, was obtained in the Mississippi Valley and Gulf States. The supplies of red-legged frogs, the only native species used commercially to any extent, were never large. The recent spread of the American bullfrog in various waters in California has greatly increased the local stock and it is to be expected that commercial requirements here will depend more and more on this species.

Since frogs are most easily obtained in the earlier months of the year when they are congregated for deposition of eggs (and are then perhaps less wary) it has been the practice to capture large numbers at that season. Such of these as were not soon to be marketed were killed by "pithing" (cutting through the nerve cord at the base of the skull), eviscerated but not skinned, and placed in cold storage. As many as 1000 dozen were formerly stored in this manner by one California dealer. These were later withdrawn as needed, skinned, and delivered to the trade. However, persons of discriminating taste prefer the finer flavor of freshly killed frogs. The presence of numerous bullfrogs in the waters of California will tend to reduce the need for accumulating supplies of frogs in cold storage here.

CLASSIFICATION OF FROGS

Frogs belong to the zoological class of animals known as Amphibia, a group including also the salamanders and toads. In evolutionary sequence they are next above the fishes and below the reptiles. The designation amphibian refers to the fact that these animals (at least a majority of the species) spend a part of their lives in the water and the balance of it on the land, usually in moist situations. The Amphibia generally are distinguished by the soft moist skin covering the body, which is devoid of external scales or other protective covering.

Among the Amphibia, the toads and frogs (Order Salientia or Anura) are distinguished by the absence of a tail in the adult and by the peculiar conformation of the hind legs which are much longer and stouter than the forelegs and adapted for leaping; the toes of each hind foot are connected together by webs. All of the frogs used for food in Europe and North America belong to the family Ranidae; they may be distinguished from the toads by the more slender less flattened form of the body, by smoother skin, by the absence of warts or enlarged glands on the back, sides or legs, by the proportionately longer legs and more slender toes, by the thinner and more extensive webs between the toes on the hind feet, and by the presence of minute slender conical "teeth" along the margin of the upper jaw. Young frogs may be distinguished from "tree-frogs" (the common small croaking animals of the California countryside) by the absence of expanded discs on the tips of the toes.

Each species of frog inhabits a particular kind of habitat and each has special breeding habits. The bullfrog, green frog, and California red-legged frog inhabit permanent ponds, while the leopard frog lives in marshy areas.

LIFE CYCLE OF FROG

The life cycle of all of our frogs is essentially as follows: at the appropriate season (different for each species) the adults gather in the water; the males clasping the females around the breast (in amphibians other than frogs, the clasping "hands" of the male are behind the "arm" or in the groin of the female). After a few hours or days, the female extrudes her eggs, and as they are passed out, the sperm of the male is poured over them and fertilization is effected. The eggs of any one female frog are usually deposited in one large mass, and become attached to weed stalks, dead grasses, or, in some species, to stones in the water. Each egg is surrounded by transparent jelly-like spherical coverings that soon swell to several times the diameter of the actual egg enclosed in the center. Development begins at once, and the blackish egg changes to an elongated fish-like embryo. The time spent within the jelly may be as short as four days or as long as three weeks, depending upon the temperature of the surrounding water, and upon the species of frog concerned. At hatching, the frog-to-be is a small blackish object with a rounded body and short thick tail, and with three short blunt external gills on each side of the neck. Later growth changes this larva (tadpole or pollywog) to a flattened ovoid form (head and body) with a long tail, bordered above and below by thin transparent fins. As growth proceeds the external gills disappear to be replaced by internal gills and the lower part of the body becomes covered with a thin transparent opercular membrane. Sometime after hatching, and thenceforth during the remainder of the tadpole stage, the animal has small thin horny jaws with which it gathers soft food. The green algae or "scum" which grows on the surface of objects in the water, and on the mud of the bottom, together with the bodies of any animals which die in the water (including other tadpoles) serve as nourishment during this stage of development. As growth proceeds the tadpole acquires legs, the hind pair developing in plain sight at the base of the tail while the forelegs are hidden beneath the thin opercular membrane. Then the "transformation" or "metamorphosis" sets in, the forelegs burst through the opercular membrane, the tail is absorbed, the gills disappear, and the tadpole becomes a small frog. It then hops instead of swimming and breathes air by means of lungs in place of the lost gills. With the accompanying changes in form and size of the mouth, the young frog begins to feed actively and thenceforth will take only *living, moving* food. There is a gradual increase in size and after two or more years, the frog reaches the fully adult size of its species.

The native red-legged frog deposits its eggs during the winter months and the larvae transform during the late summer of the same year. The laying season for the bullfrog is later (April or May to July) and in northern localities the larvae require two complete years to finish their growth before transforming. In Louisiana, however,

only one year is required and it is reported that a similarly shortened period obtains in certain other southern localities.

Frogs are "cold-blooded" animals (that is, their body temperature is controlled largely by that of the environment) and in consequence they have a period of inactivity during the winter months. In northern regions they must descend and hibernate in the water or mud below the limit of freezing. In the warmer lowlands of California the winter temperatures are higher and the cold period is of shorter duration so that a longer and more effective growing season is afforded. The rate of growth, of both tadpoles and frogs, varies with the species, the environmental temperature, and the food supply.

FROG FARMING

Efforts to rear frogs under some degree of confinement began in the United States before 1900. During the early years of the present century there was a limited interest in the subject, stimulated in part perhaps by Owen Wister's delightful and fanciful tale of frog farming in his tremendously popular novel, "The Virginian." During the past ten years the topic has received an ever increasing amount of attention. Numerous articles have appeared in newspapers and popular magazines, many of them greatly exaggerating the possibilities and the results obtained by persons who have attempted "frog farming." Recently, several companies have been formed to capitalize on the popular interest by offering "breeding stock" and "lessons in frog culture." The whole subject promises to become a craze and seems destined to follow the same excited course as did silkworm culture and fur farming. An impression has been created that frog farming is a highly profitable business, requiring only limited investment of money and time, but yielding considerable financial return. Some of the propagandic literature implies that there is a great market demand for frogs far exceeding the wild supply, that the wild stocks of frogs are far reduced, and that frogs may be reared successfully in ponds of limited size. It is true that, in certain places, the wild stocks have been depleted by over-hunting. But, as pointed out above, there is now a plentiful supply of bullfrogs in California that is contributing importantly to the local market requirements. It still remains to be demonstrated that artificial rearing of frogs in small ponds can be made a biological and financial success.

Some so-called frog farms have been nothing more than ponds where frogs captured in the wild have been held until shipped to market. Other enterprises have been more serious; definite attempts have been made to rear numbers of frogs in confinement as with "fish farms," "fur farms," and the intensive production of domestic poultry and live stock.

Between 1903 and 1918 the Pennsylvania State Department of Fisheries conducted some experiments on frog farming but the last reports stated that "the propagation of tadpoles and frogs is very interesting although very uncertain * * *," and that "experiments and observations * * * found * * *" it would not be commercially valuable to propagate the frog for commercial purposes * * *. Under date of 1931 the Louisiana State Department of Conservation,

Division of Fisheries, in Educational Pamphlet No. 2, on the "Frog Industry in Louisiana" stated (p. 19) that "No frogs are raised commercially; * * * there *have* been attempts to raise frogs on a commercial scale in Louisiana and in no case has the trial been a success." Neither the U. S. Bureau of Fisheries nor any of the other State fish and game commissions have ever given more than casual attention to the subject.

Continued search by the author for successful farms which have reared frogs in numbers for sale as meat has failed to discover any such enterprise which persisted over a term of years and proved independently profitable to its owner.

At Stege (later El Cerrito), Contra Costa County, California, on the ranch of Richard Stege, a frog farm was maintained from about 1898 to 1907. Miss Edith Stege was primarily in charge of the venture. Four artificial ponds totaling between four and six acres in area were used. They were stocked with both the native California red-legged frog and the American bullfrog, three dozen of the latter having been purchased from somewhere in the eastern States about 1898. Eggs and larvae were kept in a small spring-fed pond, the older frogs in three larger ponds, fed by overflow from the smaller one; these ponds were interconnected by culverts. The ponds were fenced with closely placed boards, to a height of about three feet. At the top was an inturned rim of tin, to prevent escape of the adult frogs. The ponds had no lining other than earth. They contained numerous aquatic plants, which provided shelter for the frogs and also for the numerous aquatic insects that served as food for the frogs. Upon discovering, by accident, that large numbers of frogs were hibernating one winter in a culvert between two ponds, an effort was made to provide individual hibernating places by boring holes laterally into the bank below the water level, by use of a post-hole auger. Thenceforth, it was possible to capture frogs if necessary during the winter hibernation period when they were ensconced in these holes. The frogs were roughly sorted as to size in the different ponds to prevent too many of the smaller frogs being eaten by the larger individuals.

No especial attempt was made to provide food. The tadpoles fed on the green algae in the small pond. Older frogs captured insects, small fish, some of the younger frogs, and many of the small Pacific tree-frogs (*Hyla regilla*) which were abundant in the ponds. The various enemies of frogs had to be reckoned with and destroyed whenever found. These included sea gulls, herons, ducks, and water snakes.

This "frog farm" was but a side issue on a large general ranch, and costs of construction and labor were not assessed against the venture. No detailed figures are at hand concerning the numbers of frogs reared. Certain published statements as to the amounts received for frogs were wide of the truth. On one occasion seventy dozen frogs were shipped to Hilo, Hawaii. Others were sent to restaurants in San Francisco. The maximum price received was \$10 per dozen for large bullfrogs dug out of the mud in winter. Ordinarily, large bullfrogs were sold at \$4.50 to \$5 per dozen.

There are several published references to a "frog farm" maintained at South San Francisco in the early 1900's by S. C. Coombes, but two competent witnesses have stated to the writer that the Coombes'

"ranch" was merely a series of ponds where frogs captured in the coastal counties of California were held until sent to market.

At the present time there are numerous attempts at frog farming in the United States, several being in California. All so far as known are using the American bullfrog. Some of these enterprises are of considerable size. Only time will show whether any of them will prove profitable to their owners. It is reported that intensive culture of bullfrogs is being practiced in Japan with stock introduced from the United States. The meticulous care which the Japanese use in all efforts at artificial culture of animals in confinement and the relatively low value of labor in that country may make for results there not readily obtainable in this country.

The principal difficulty in artificial propagation of frogs is that of providing an adequate supply of food for the animals after transformation, because frogs will then take as food only objects which move. Another is that of protecting the larvae from the predaceous aquatic insects abounding in any outdoor pond; still another is that of preventing the larger frogs from devouring the younger ones. Epidemic disease may also enter as an adverse factor at times.

Frogs form part of the natural food of mink, raccoons, skunks, (even "house rats" at times), herons, certain ducks, kingfishers, garter snakes, and certain fishes. Any or all of these animals as well as certain water beetles and bugs and the larvae of dragon flies will feed upon the tadpoles. Adequate fencing would keep out the mammals and the snakes. Birds might possibly be excluded by a network of wires over the ponds. Predaceous fish could be screened out or otherwise excluded from ponds containing frogs, but there is great difficulty in excluding the insects; furthermore, the latter, while injurious to tadpoles, serve importantly as food for the transformed frogs.

In nature all of these "enemies" play a part in regulating the frog population. Thus, while a female bullfrog may lay 10,000 eggs and a red-legged frog 3000 eggs per season, in either case only *two* of these need to become mature frogs in order to maintain the species! A wide "margin of safety" is thus provided against destruction of eggs by predaceous animals, fungus or drought, and of the larvae and maturing frogs by any of the animals just named.

Exposure of boards smeared with honey or molasses, or of scrap meat or fish, close to the ponds and suspending either kerosene or electric lights over the ponds at night, all with the thought of attracting insects, are expedients tried in attempts at solving the food problem. More recently, top minnows (*Gambusia*) have received attention. These small fish multiply readily in ponds similar to those used for frogs and their increase may be used as food to supplement the insect supply. Other aquatic animals have been tried. Mention will not be made of these here, since the introduction of alien animals into our waters may prove harmful to fishing and agricultural interests; furthermore such introductions are now subject to legal regulation under a bill passed at the 1933 session of the California Legislature.

CAPTURE OF FROGS

Frogs are captured in a variety of ways. In the marshlands of the southern States the hunters work at night, walking in the water and

using a spotlight. When the lamp is flashed on a frog sitting on the bank the light momentarily blinds the animal which is quickly seized by the hunter and thrust into a sack which he carries. On some waters a boat may be used and a deep cylindrical net on a long handle is of assistance in capturing the frogs. The proverbial method of a bit of red flannel on a fish hook dangled at the end of a short line on a long pole can be employed in some places, although the wariness of the larger frogs to close approach does not always make for success. Some frogs are shot with small rifles, although this method leads to loss of numerous frogs which sink or, being injured, escape only to die later. Special gigs and "forceps" also have been designed for capturing the animals. Whenever possible frogs should be taken without injury, since they may then be kept alive until wanted for use or until marketed.

CARE OF LIVE FROGS

After capture, frogs may be kept for a short time in a dampened sack, but as soon as possible they should be transferred to a larger container, preferably a wooden box large enough so that the frogs do not occupy more than one-half or one-third of the floor space. All of the inner surfaces of the box should be padded with several layers of burlap sacking which will prevent the animals being injured as they jump about. This padding also should be well wetted to provide moisture for the animals. Moisture is necessary for frogs being transported anywhere, and particularly in the hot lowlands of California. Frogs do not drink, but take in moisture through their skins. If kept in a dry atmosphere they lose moisture (and weight) rapidly and may die if not safeguarded in this respect.

PREPARATION FOR THE TABLE

When live frogs are to be prepared for the table the animals are killed by a transverse cut at the back of the head, skinned, and eviscerated. They are then washed clean, dried on a towel, rolled in a batter and fried in deep fat. Large bullfrogs should be cut into pieces before cooking. Frog meat is white, delicate, not unlike chicken, and methods used for cooking young chickens may be employed in preparing frogs for the table.

SUMMARY

In summary, then, there is a limited use of frog flesh as human food and of entire frogs for scientific purposes. The acclimatization of the American bullfrog in the lowland waters of California has provided a stock of large frogs, suitable for both of these purposes. Much of the area now inhabited by the bullfrog was previously unoccupied by any frog whatsoever so that the species constitutes a distinct addition to the fauna of the State. With moderate "harvesting," a portion of the adult population can safely be levied upon year after year without depleting the supply. To safeguard against depletion a limit of 24 per day or 48 per week of frogs not less than four inches in head-and-body length has been set by State law (Chapter 459, California Statutes of 1933).

Efforts at artificial propagation of frogs have been made for many years without any significant success, and it is very doubtful whether such work will ever be more than a pleasant avocation. Certainly, investment of time and money in a "frog farm" with hope of commensurate financial return is, as yet, a speculative venture.

Persons interested in "frog farming" should visit one or more such farms (which are usually known to local game wardens), should inquire fully as to details, and should be particularly cautious about investing any considerable sum of money in such a venture. There are no important "secrets" about frogs. "Breeding stock" can either be captured in the wild or else purchased at moderate prices through the regular trade.

FURTHER INFORMATION

Information on the identification of frogs and their eggs and larvae, and on the ranges, habits and life histories of frogs may be obtained from the following books, which may be consulted in many public libraries or which may be obtained from the publishers at the prices indicated.

Dickerson, M. C. 1906. The frog book. (New York, Doubleday, Doran & Co.) xvii + 1—253 pp., 16 colored pls., 95 half-tone pls., 35 text figs. Price \$5.00.

Storer, T. I. 1925. A synopsis of the Amphibia of California. University of California Publications in Zoology, Volume 27, 342 pp., 18 pls., 42 figs. (University of California Press, Berkeley.) Price \$4.50.

Wright, A. H. 1914. North American Anura—Life-histories of the Anura of Ithaca, New York. Carnegie Institution of Washington, Publication No. 197, vii + 98 pp., 21 pls., 1 fig. Price \$2.00.

Wright, A. H. 1920. Frogs: their natural history and utilization. Report of U. S. Commissioner of Fisheries for 1919, 44 pp., 22 pls., 2 figs. [= Bureau of Fisheries Document no. 888.] Sold by U. S. Superintendent of Documents, Washington, D. C. Price 20 cents.

CALIFORNIA FISH AND GAME

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No. 3

WILLIAM H. SHEBLEY 50 YEARS SERVICE

William H. Shebley, fish culturist, has achieved a distinction that falls to the lot of but few men in any calling. On May 16, he completed 50 years continuous service with the Division of Fish and Game and on that date he took his retirement under pension. He expects to spend the many years his legion of friends hope are ahead of him enjoying himself in his Sacramento home, and fishing in the streams and lakes in California he has done so much to stock with game fish.

Entering the service of the Fish and Game Commission in 1883 as a fish culturist in a calling that came natural to him, his father being a noted game fish authority in Illinois and the first fish culturist in California, William Shebley was assigned to the Shebley Hatchery, in Nevada County. This hatchery was one of the three operated by the State commission at that time, and was named after Shebley Senior.

From this hatchery, "Bill" was sent throughout the State. He studied streams and lakes, as well as all other waters where sport fish might thrive. He imported various species of trout and planted them in these waters. He watched and observed the results of his work, and so thorough was he in his endeavors that he soon became recognized as an authority, and was elevated to many responsible positions in the service. For twenty-one years he was in charge of the Bureau of Fish Culture, and the work he did in that capacity has resulted in the waterways of California being well stocked with fish, and the innovations he introduced have been adopted by this and other western States.

He assisted the United States Bureau of Fisheries in establishing the first salmon egg-taking station and hatchery, and through this cooperation, and his comprehensive knowledge of this species of fish, he has kept streams they adopted stocked with salmon.

He planted the first trout in the waters above the floor of the Yosemite Valley. The first trout ever planted in Big Bear Valley Lake in San Bernardino were planted by Shebley, back in 1886. He introduced the Loch Leven, eastern brook and other varieties of trout into the waters of this State, and through his consistent and persistent

efforts has furnished sport to millions of anglers in the fifty years he has been with the division.

It is estimated he has supervised and been responsible for planting over one billion trout and salmon through the State.

The splendid California hatchery system now having twenty-eight plants in all, was developed through the efforts of Shebley, and through his vision, the stock of game fish will be ever ready to meet the demands of increased population and easy accessibility to streams and lakes.

When it is considered he has served under 16 governors and scores of fish and game commissioners, holding over from one administration to another, with no wire pulling or playing of politics, adhering to his



FIG. 69. Governor James Rolph, Jr., congratulating W. H. Shebley on Shebley's fifty years' service. Photo by McMurry, May 16, 1933.

policies and justifying them, one can think of no greater tribute to the success of any man.

Ever popular with the men and women with whom he worked, men and women who recognized his genius, this popularity was manifest on the evening of May 16 in Sacramento, when Shebley was tendered a banquet in the Elks Club.

This affair followed a meeting between Shebley and Governor James Rolph, Jr., during which our chief executive warmly commended the splendid record of service of the retiring fish culturist and extended the sincere wish for many years more of happiness.

At the banquet were many of his old cronies in the division. Leo K. Wilson acted as master of ceremonies, and J. Dale Gentry, president of the Fish and Game Commission, toastmaster. On behalf of the

division, Wilson presented the retiring Shebley with a trout fishing outfit, remarking that here was one angler who would probably never complain of the lack of fish in the streams and lakes of the State.

Speeches were made by Gentry, Commissioner Earl Gilmore, Director of the Department of Natural Resources, D. H. Blood, attorney Eugene D. Bennett, executive officer John L. Farley, George Neale, N. B. Seofield, J. S. Hunter, Leo Wilson and Opie Warner. Others present at the banquet were E. L. Macaulay, John Spencer, James Vogt, H. R. Dunbar and August Bade.

Commissioner I. Zellerbach was unable to be present, being on his way to New York.

Shebley, feelingly and modestly replied to the many compliments given him, and thanked all members of the division for the loyalty they had extended him during his half century in the department.

CAPTAIN WALTER R. WELCH RETIRES

Another veteran of the Division of Fish and Game retires on pension this month. Walter R. Welch, captain of patrol, for years in charge of volunteer wardens, completes a long and successful career in the work of conserving and protecting fish and game.

Captain Welch first became identified with the division in 1897, when he was made a deputy fish and game commissioner for Santa Cruz County. He remained in this work until 1901 when he was brought to the San Francisco office as a warden.

In 1907, he was made a county fish and game and fire warden for Santa Cruz County, activities he maintained until 1915, when he became affiliated with the San Joaquin Valley Fish and Game Protective Association. As an official of this organization he did much to promote and have passed the license fee laws and the deer tag legislation. He left this work and returned to the Division of Fish and Game as a field assistant to the executive officer.

A year later he was made a captain of patrol and put in charge of the volunteer wardens, a position he has maintained until his retirement.

In this work he has brought into play his vast knowledge of fish and game, and has introduced many innovations for the conservation of these great natural resources of the State.

It was through his energy and understanding that the 466 quail sanctuaries in forty-four counties of California were established, posted, stocked with upland birds which have been cared for and protected mainly by volunteers. On these 466 sanctuaries, comprising 312,139 acres there are reported to be 148,886 valley quail and over 7500 mountain and desert quail, which number under the absolute protection afforded them are increasing each year.

In dealing with juvenile game law offenders, he has inaugurated a system of citing the offenders to appear before him, rather than having them arrested. By calling the offense to the attention of the juveniles' parents, he has succeeded in getting results that have greatly minimized this sort of law breaking.

Captain Welch leaves the division knowing he is held in the highest esteem by all those who have worked with him during his long association with the department.

A CORRECTION

In CALIFORNIA FISH AND GAME, volume 19, number 2, (April 1933) in the article "Description of a Giant Squid Taken at Monterey, with Notes on Other Squid Taken Off the California Coast" by J. B. Phillips, the following correction is to be made:

Page 134, paragraph four, sentence two, reads as follows: "The decapods are differentiated mainly by the presence of ten arms, eight long and two short." This sentence should read, "The decapods are differentiated mainly by the presence of ten arms, eight short and two long."

BULLFROGS FOR SPORT

When Assembly Bill No. 970, introduced by Assemblyman E. H. Zion, of Modesto, becomes a law August 21, 1933, eastern bullfrogs will be officially recognized as a game species throughout California. This measure places a daily bag limit and a size limit upon this introduced species which has become acclimated so completely that it is providing food and sport in many parts of California.

Dr. T. I. Storer, of the College of Agriculture of the University of California, has worked out the distribution of the American bullfrog (*Rana catesbeiana*) in California from data in the files of the Division of Zoology, College of Agriculture. This species is reported common in northern San Joaquin Valley and in parts of the Sacramento Valley at least from near Biggs southward. The area is probably spreading yearly in the central valley. Bullfrogs are also to be found in the Lake Tahoe section where in the meadows around the upper Truckee River they are said to be increasing rapidly. Through the efforts of various sportsmen's organizations they have been introduced into the lake areas of that region and may be expected to spread throughout the entire section. North and south of San Francisco Bay in Sonoma, Santa Clara and Tuolumne counties, frogs have been introduced and are becoming quite abundant. Records also indicate that they are present in Mono, Inyo, Los Angeles, Orange, Riverside and San Diego counties.

During the past few years, there has been considerable interest in the matter of frog farming in this State. For the information of those contemplating this venture, a statement by Dr. Storer on certain biological features of frogs and connected with this work is published in this number of CALIFORNIA FISH AND GAME.

Several methods are used in the capturing of bullfrogs for sport. Some people, particularly those who are fishermen at heart, like to take them with hook and line, using a bit of highly colored cloth, or an artificial trout fly as a lure.

Others take them by means of shooting with a small caliber rifle. Still others prefer to take them with a switch or a stick, stunning them with a sharp blow and recovering them before they regain their ability to hop.

In any event, they are beginning to be appreciated as an article of sport and food and in time should be a valuable addition to the wild life of this State.



FIG. 70. Bullfrogs taken in the sloughs near Modesto.
Photo by Perc Meakin.

WEBB TOMS AND RATTLESNAKES

In June 1932, the following account written by Tom Drummound appeared in the *San Diego Union*.

This thing of being a rattlesnake isn't so hot—judging by a picture of all the rattles taken from snakes in the course of one man's patrol activities in the last quarter of a century. Game Warden Toms destroyed 67 snakes and the very first one supplied the big thrill. It

happened in Otay Valley, on the old Daneri Rancho—but let Mr. Toms tell it:

"I arrived at the water trough, climbed down from my bike, got out my collapsible drinking cup and indulged in thoughts of cool water chasing down my throat. I was thirsty and I was new to the snake game here. That's why I stepped carelessly up to the trough, and as I leaned over to dip a cupful, my foot slipped.

Instinctively, my left hand shot out and chugged against the gully bank, close to the trough. As I did this my eyes suddenly visioned a thundering big, red diamond back, head drawn back, tongue darting in and out of its mouth.

There was no conscious thinking in getting my hand out of danger—it just flew back! And as I straightened up I thought 'You darn



FIG. 71. Former deputy Webb Toms and trophies collected in the course of patrol work in southern California. Photo by Lee Passmore.

near bumped into the man with the scythe!' That snake never made a sound, just lay there ready for business. I introduced it to a club and pretty soon had his rattles. Then I got a drink. You hear talk about reaction and I guess it means back-tracking mentally, sometimes with odd results. I know my reaction was to get scared plenty—after I was plenty safe which is the only time I ever was really frightened by a rattlesnake."

Sixty-seven separate sets of rattles are shown and the warden's average has been about three a year. In 1931 he killed five, and in 1932, only one.

COMMERCIAL FISHERY NOTES

TUNA BY RAILWAY FROM MEXICO

During the middle of June, 1933, three carload lots of tuna were brought up from Mexico to a cannery at Long Beach as trial shipments. This yellowfin tuna was iced and loaded about four feet deep in refrigerated cars and after the four-day trip by rail was unloaded in excellent condition. Each car held from 14 to 17 tons of iced fish. This was purse seine caught tuna taken in the Gulf of California in the bay near Guaymas and landed at that port for shipping by rail. A Mexican company with some American capital plans to operate several California purse seine crews this season so that this avoidance of the long haul by boat may be the beginning of a new trend in the tuna trade.—W. L. SCOFIELD, California State Fisheries Laboratory, June, 1933.

THE MACKEREL INDUSTRY

The early summer of 1933 has seen the heaviest pack of mackerel at San Pedro canneries since 1929. During the last three years there has been considerable mackerel canning, but nothing to compare with the boom days of 1929. During the last week of May and throughout June, a fleet of 45 big net boats and four hook and line craft fished regularly for five canneries that were taking all the fish they could get. The mackerel fleet represents a total of approximately 400 fishermen, the greatest number fishing for mackerel at one time for years. The daily catch fluctuates between 50 and 200 tons, resulting in a daily pack of 900 to 3600 standard 48-pound cases.

The most important competitors of canned mackerel are the cheaper grades of salmon. The prices of mackerel and cheap salmon have been equally low for several years and the better known salmon crowded mackerel off the market to a large extent. Last winter, however, the price of salmon advanced substantially, enough to place it out of reach of the great Negro market of the southern states which then turned to mackerel as in 1928. Consequently orders have been pouring into the mackerel canneries since the first of the year. Canning was at a standstill until about May 20, however, because the fish could not be caught. The uniformly cold and windy weather of the spring months was probably responsible for the scarcity of mackerel during that period.—RICHARD S. CROKER, California State Fisheries Laboratory, June 14, 1933.

A MARINE DRAMA

One day at noon, the first week in March, the lobster tender *Pearl* came into San Diego from the Coronado Islands, a distance of about 12 miles, with a cargo of lobsters and by 1.30 that afternoon they had all been sorted and inspected for size. From this cargo seven under-

sized spiny lobsters were confiscated. There being a minus tide about that hour of the day, it was decided to make a patrol of Point Loma and watch for persons gathering abalones or lobsters, the local season being closed on both, and at the same time return the confiscated "bugs" to the ocean, the usual form of procedure carried out by Division of Fish and Game Deputies Maddox and Smith in handling illegal size confiscated Mexican lobster at San Diego. Upon arriving at Ballast Point where the undersize "bugs" were to be returned to the ocean, they were thrown overboard off an old pier into about four feet of clear water and about 12 feet out from the pier edge. The lobsters could be distinctly seen seeking hiding places as they crawled around on the bottom of the bay. One of them was making for an old piling and in order to attain his objective had to pass within about six inches of the mouth of a piece of six or eight-inch drain pipe. As he did so the slimy arm of an octopus shot out of the opening of the pipe and dragged him, struggling violently, to the pipe where he was held firmly across the end of it. The octopus, securely braced in the entrance of his retreat, held on grimly while the lobster, who had been turned on his back during the struggle, fought bravely to loosen his enemy's grip. They stayed in this position for some few minutes when one of the spectators felt he was not seeing enough action and threw a small pebble which must have either struck or frightened the octopus because he freed the lobster which swam rapidly away immediately to about six feet from where he was first attacked, hotly pursued for about three feet by the octopus who then lost his enthusiasm and returned to his den. After remaining still for about 10 minutes regaining his breath or recovering his nerve, the lobster proceeded towards a piling within about 18 inches of the mouth of the pipe where his enemy was lurking. When the lobster was at his closest point to the octopus, en route to the piling, the octopus stretched out an arm and tried to reach him but fell short a few inches. While this attempt was being made on his life the lobster proceeded in the most unconcerned manner for the piling, not deviating in the least from his course and upon arriving in the shelter of the piling and its growth of mussels remained facing toward the octopus which was only about three feet from him, apparently not the least bit frightened by the close proximity of his potential enemy where he remained when last seen. The shadow of Point Loma falling across them made it impossible to watch them longer.

This lobster was ten and a quarter inches long and had been out of the water about three and one-half hours when returned to it so he may have been in a somewhat weakened condition when first attacked, which may have been the reason the octopus seemed to experience no difficulty in subduing him when he first launched his attack. It was apparent that the octopus did not care to attack in the open and retained his foothold on the edge of his den and would not care to advance away from the entrance even when the lobster returned to within two or three inches of his reach. His reluctance to leave his fortress may have been due to natural timidity or to fright caused by the audience moving about above them on the pier or fear caused by the numerous pebbles cast in his immediate vicinity; at any rate he refused to do battle when apparently he could not have the advantage of a surprise attack which his protective coloring furnished him by

mother nature and the pipe opening provided him by fate of circumstances. The lobster's whole attitude, except while actually in the clutches of the octopus, showed either stupidity in not realizing his danger or courage in returning towards the piling, and by so doing exposing himself in such a reckless manner as to be almost within reach of the octopus. The lobster kept his head toward his enemy most of the time but it was impossible to tell whether by accident or design, as the lobster travels both forwards and backwards; he no doubt considered his protective armor sufficient defense against an attack.

The significant part of the whole little drama is, in my opinion, that the octopus is a potential enemy of the spiny lobster which may not be generally known and therefore this little episode may prove of interest to our readers.—COBURN F. MADDOX, Division of Fish and Game, San Diego office.

TUNA TENDERS AT THE EQUATOR

During the early part of 1933, two large tender vessels left Los Angeles harbor on a trip to the equator to bring back tuna from the tropical banks for the San Pedro canneries.

One, the *Sierra*, formerly had been fitted with sharp freezing and holding equipment for transporting frozen reindeer carcasses from Alaska to Seattle. The same refrigeration equipment was used on the trip to the equator to freeze and keep the tuna. This vessel took several little jig boats or trollers to use in catching the tuna. Upon arrival at the fishing grounds, it was found that the jig boats did not catch the fish in sufficient quantities and so they sent for a purse seine boat, which proved more successful than the smaller boats. Due to mechanical difficulties, the five-month voyage resulted in much less than a full boatload.

The other, the *Centralia*, had been a lumber schooner several years ago. On its voyage to the equator, it had aboard ice and a small refrigeration plant for supplemental use. This vessel started out with one purse seiner in tow. Their first venture came to an unsuccessful end when the purse seine boat was wrecked after catching less than a hundred tons. The *Centralia* returned to San Pedro, and on the next trip took another purse seiner. This second trip was much more successful as a good load of tuna was brought back.

During this 1933 season, several live bait boats acted as tenders for purse seiners or took one along to aid them in catching tuna.—S. S. WHITEHEAD, California State Fisheries Laboratory, June, 1933.

CLAMS FROM LOWER CALIFORNIA

A new sea food is about to enter the markets of California if present plans of a group of producers mature. It is the Cortez clam (*Dosinia ponderosa*) which inhabits the sandy beaches of the Gulf of California in great numbers. In habits and appearance it closely resembles the well known Pismo clam. The shell has the same smooth varnished appearance, and internal differences are slight. The prin-

incipal distinction lies in the shape of shell; that of the Cortez clam is much more rounded and lacks the sharp angle typical of the Pismo clam. (See illustrations.)

The Cortez clam is now brought to California markets by truck in experimental quantities. As it can remain alive out of water for several days, there is no loss due to spoilage. The flavor and texture of the meat are practically identical with the Pismo clam.

Another group of producers is at present engaged in experimental digging of Pismo clams on the beaches of the west coast of Lower California and plans to bring them into Newport by boat. Pismo clams are said to be both large and abundant on some of the Mexican beaches and no difficulty is anticipated in supplying the demands of the southern California market. In the event that the project is carried through, the importations of Pismo clams will be subject to inspection by the Division of Fish and Game so there will be no chance of illegally selling local clams claimed to be from Mexico.

Photographs (Figs. 72 and 73) of the Cortez and Pismo clams are appended in order to facilitate the identification of the two similar species.—RICHARD S. CROKER, California State Fisheries Laboratory, June, 1933.



Fig. 72. Cortez clam (*Dosinia ponderosa*) from the Gulf of California. Upper figure shows exterior of shell; lower figure is of interior. Photographs by D. H. Fry, Jr.



FIG. 73. Pismo clam (*Tivela stultorum*). The upper figure is the exterior of a shell from Lower California; lower figure is interior of a California shell. Photographs from F. W. Weymouth.

DIVISION ACTIVITIES

BUREAU OF FINANCE

Though income from fishing and hunting licenses fell off during the fiscal year ending June 30, income from commercial fisheries activities indicated an increase.

The decrease in license fees is attributed to the economic conditions that have prevailed for the past few years. With the coming year giving every indication that conditions will improve the outlook is more encouraging for the present year.

Angling licenses fell off the past year, as compared with 1932, though hunting licenses displayed an increase of some \$45,000 over the year just past.

Unsettled weather during the opening of the angling season had its effect in the sale of those licenses. With weather better, and fish plentiful as a result of the heavy planting of trout the past few years it is expected the sale of angling licenses will hold up well before the present fiscal year is ended.

The deer hunters were not to be encumbered with the metal deer tags that accompanied the card-board permits last season, it being decided to abolish these metal fasteners.

Collection of all licenses, tax fees and other charges has been up to that of past years, but few owing the Division of Fish and Game being remiss in this matter.

BUREAU OF GAME REFUGES

Wild ducks have taken to the State owned waterfowl refuges in a big way. During the nesting season there were over 2000 ducks permanently located on Gray Lodge, and they produced many broods of ducklings. On the Suisun refuge sprig and mallard nested and hatched abundantly, sprig predominating. Los Banos reports many broods of young ducks that showed up in great numbers early in the morning. On the Salton refuge cinnamon teal and mallards raised families in greater numbers than heretofore. Tree ducks were more numerous throughout the nesting period this year, than for many seasons past.

On the Suisun refuge some difficulty was experienced on the outside levees. There are 12 miles of retaining walls constructed some 30 years ago. Some sections of this mileage gave in and a dredger had to be called in to fix the damage. All but a mile or so of the levee has been cleared of wild roses, so that patrolling the area is made more easy.

On the Gray Lodge refuge the crop of young pheasants is much larger than past years.

Water conditions at all the refuges have been more than pleasing during this year.

For the first six months of 1933 there were 164 mountain lions scalps turned in, which is 22 under the annual average for the past

four years. April saw 29 lions killed by lion hunters, May 23, and June 27.

Game breeders have taken out 339 licenses during the first part of this year. This is about the same as for a like period in 1932.

Fur animal raisers have filed their reports. The sale of furs for the past year was a little over \$8,000 and the plants are carrying over a heavy supply of skins.

BUREAU OF GAME FARMS

The present season is giving every indication of a prolific one among the pheasants and quail of the game farms. In June there were 101,536 pheasant eggs laid and 6142 quail. The hatch for the month was 3775 pheasants and 1738 quail. The pheasant crop of eggs for May was 10,828, and quail 3880. April's output was about the same.

Interest among sportsmen and sportsmen's clubs continue to increase, and more demands for pheasant eggs and young birds have been received, and more orders filled than in any year the game farms have been established. Pens have been built in many counties of the State, under plans furnished by this bureau and the loss of birds that have been shipped, and the loss in incubation in these outside plants has been very low. It has been impossible to supply all the demand made for birds and eggs.

An order was placed with private pheasant and quail breeders for 10,000 quail and pheasants. The quail order being for 7000 birds. The breeders were enthusiastic in their promises to be able to fill the order, but as the time for delivery neared there seemed to be some question as to whether the number of birds desired would be delivered.

Better feed has been obtained through exhaustive experiments for the birds. Improvement is continually being made on incubating and brooding facilities, and the electrical equipment continued to handle more birds than could be handled by having the eggs hatched by chickens.

In southern California Gordon True in charge of quail refuges has completed his work in San Bernardino and most of Los Angeles counties, and is now engaged in this line of endeavor in Orange County, intending to move from there to San Diego when Orange is finished.

BUREAU OF COMMERCIAL FISHERIES

With the close of the sardine season in southern California on April 1, the canners found their supply of tinned fish less than usual, as the pack had not been as heavy as in past years. There is expected to be a greater domestic demand as well as increased imports before the season opens in the Monterey area in August. The prices are expected to be more attractive than in former years. The price of sardine oil has soared to as high as 20 cents a gallon, and prices for meal has advanced way over last year's figures.

It has been announced that contracts for 2,400,000 gallons of oil for as high as 17 cents a gallon has been made for the present year. Fish meal has gone up to as high as \$36 a ton. The price to be paid fishermen for delivering sardines to the canneries and the reduction

plants will be around \$6 a ton. Owing to the new law taking off the regulations whereby fish meal and flour was specified for human consumption, and permitting the Fish and Game Commissioners to fix the annual tonnage allotted to each plant irrespective of purpose, it is expected there will be great activity in the sardine industry.

Of course any price fixing between canners and fishermen must have the approval of the NRA authorities.

The sardine fishermen and canners are working out a code now to be submitted to the national government regulating their work.

The salmon season opening in April was not very successful in the Monterey district during April and the first part of May. Many boats went as far north as Bodega Bay, Fort Bragg and Point Reyes for their fish. Salmon held around 6 cents a pound, though some brought only 5 cents, and in some instances the price was 7 cents.

Bad weather hampered the first part of the trolling season for salmon in the northern district, but after May 15 there was an increase in the salmon catch.

In his circular No. 7, S. H. Dado on fresh and canned fish for the year 1932 shows:

That the amount of fish and shell fish delivered by fishermen in 1931 was 429,927,091 pounds and in 1932 it was increased to 440,929,986 pounds.

More than 11,000,000 pounds of sardines were brought in during 1932 than were taken in 1931;

That there was more skipjack and yellowfin tuna caught for California canners this year than last;

That bluefin tuna, barracuda, bonito, salmon, sole and rockfish showed a decrease.

That the sardine pack fell off more than 700,000 cases over 1931;

That less tuna was canned in 1932 than last year; but for the first time tuna led sardines in the total year's pack.

That more sardine oil and meal were produced in 1932 than in any year except 1928 and 1930.

And that over 600 less commercial fishing licenses were sold the past year than the year previous.

Eastern oysters seem to develop as quickly in Elkhorn slough as has the Japanese oysters, first used in experimentation in that locality. Experiments are now being carried on under the direction of Paul Benot to get imported oysters to spawn in Elkhorn Slough. A new dike has been put in that the temperature of the water may be regulated to the proper degree for spawning. It is hoped to be able to produce here, all the seed oysters needed along the California coast.

For the first time in five years crabs in great numbers have appeared in the Monterey Bay. So great were the catches that the price was driven down to 75 cents a dozen.

N. B. Scofield, chief of the bureau, went to Salton Sea and Lake Elsinore and after a careful study recommended that silver salmon and striped bass be liberated in both these bodies of water, that there might be produced fish for the sportsmen in that section of the State. As a result 40,000 silver salmon have been shipped from Brookdale, and are being held in rearing ponds at Forest Home until the proper time for planting.

BUREAU OF FISH CULTURE

The taking of trout eggs throughout the State has been very successful this year. The late rains of the spring seemed to facilitate the work. During June, alone, there was taken 2,384,943 eggs from the egg taking stations and produced in the hatcheries, which is about a million and a half more than is usually taken in this month.

The number of eggs taken and received to June was 43,000,000, an increase over the first six months of 1931.

The planting of trout fingerlings has gone on in splendid fashion. To May 30 there had been 8,861,321 released in the streams and lakes of California, some two million more than for a similar period last year.

There has been over 4,500,000 salmon planted in State streams this year.

The Friant small mouthed black bass seems to have been a success during its first year. Nearly 5000 fingerlings from the new plant were shipped to San Diego County in June. The loss in transportation was less than five per cent.

Before the ponds are cleared of all small bass to be put in other localities of the State, there will have been some 40,000 of these great sport fish furnished to anglers. The sportsmen of Fresno deserve great credit for their aid in this undertaking, which was started with many misgivings and numerous complications.

A goodly supply of brood stock is being carried over for the next season, and with the experience gained during the first year, Merrill W. Brown, in charge of the plant will undoubtedly double the output the coming year.

Steinhart Aquarium, Golden Gate Park, San Francisco, presented the Division with 75,000 grayling fingerlings which were taken to the lakes in the higher elevations of Yosemite National Park and liberated.

BUREAU OF FISH RESCUE

As the summer months caused many bodies of water to recede, and in some instances dry completely up, the work of this bureau was one of great activity. The fish rescued during the three months ending June 30 totaled more than two million of seven varieties of sport fish. The large mouth black bass lead all others in this rescue work. Over 1,700,000 were saved from shallow water and taken to areas where they would have an opportunity to increase and grow into splendid fryingpan food.

During June, George Neale, chief of this bureau, supervised the taking of 6500 small mouth black bass from Salt Springs reservoir. These fish were taken to Yolo and Mariposa counties where they were planted in suitable waters in the upper stretches of Putah Creek. Fish and Game associations in each county gave assistance in placing these bass.

There is a growing demand for black bass throughout many areas of California. Where trout do not thrive, black bass seem to propagate and develop faster than most sport fish. The Division is encouraging the saving of as many of these species of fish as possible in sections where water conditions threaten them to destruction.

BUREAU OF PATROL

Most of the patrol wardens have been furnished with new transportation equipment. The use of privately owned cars by the deputies has been almost entirely abandoned, and in the place of these the wardens have been given closed cab pickups, and from figures presented they have rendered satisfactory service at much less cost. While they do not give the appearance of comfort that sedans do, they do the work.

The opening of the trout season this year was like a year ago, and the wardens had less work checking licenses. The rain kept hundreds of anglers from streams and lakes. However, as the season progressed and weather conditions became normal, the fishermen got into their stride and the general opinion was that fishing was excellent. In southern California where hundreds of thousands of aged fish had been planted the early anglers had a field day.

Arrests for angling law violations were less than 200 during the past three months.

While arrests over the fiscal year ending 1933 showed a slight decrease over the preceding year, the fines collected displayed a decrease of more than \$14,000. This is explained by the fact that many magistrates hesitate in levying fines from people who seem to be out of work, and give in lieu thereto, a suspended sentence.

There were 42 arrests made for killing deer and possessing deer meat out of season.

Fifteen wardens were laid off due to the budget restrictions. Many of these were offered work in temporary positions as cannery inspectors.

SIX YEAR RECORD OF DEER KILL IN CALIFORNIA

	1927				1928				1929				1930				1931				1932			
	2-point	3-point	4-point and over	Total	2-point	3-point	4-point and over	Total	2-point	3-point	4-point and over	Total	2-point	3-point	4-point and over	Total	2-point	3-point	4-point and over	Total	2-point	3-point	4-point and over	Total
Alameda.....	171	42	7	220	198	54	11	263	205	64	6	275	161	74	17	252	102	48	8	248	125	32	7	164
Alpine.....	14	21	32	67	20	23	23	66	24	32	33	89	54	27	43	124	44	38	47	129	64	65	62	191
Amador.....	19	18	22	59	28	31	19	78	32	27	28	87	40	26	35	101	39	32	33	104	25	28	16	69
Butte.....	74	68	86	228	80	71	61	212	82	70	82	234	113	100	101	314	152	172	170	494	100	94	93	287
Calaveras.....	50	47	52	149	77	65	49	191	61	58	56	175	118	86	79	283	81	84	62	227	63	51	34	148
Colusa.....	161	70	26	257	162	84	26	272	184	85	28	297	220	95	28	343	189	85	30	304	125	61	12	198
Contra Costa.....	4	1	5	10	5	1	6	12	11	2	1	14	5	1	6	12	7	4	1	12	6	2	0	8
Del Norte.....	16	12	14	42	18	10	20	48	27	13	15	55	8	19	13	40	11	12	15	38	6	6	1	13
El Dorado.....	183	173	170	526	173	183	159	515	215	21	180	597	262	227	196	685	260	209	230	699	166	162	134	462
Fresno.....	215	170	207	592	292	230	241	763	283	232	249	764	325	285	283	893	353	283	306	952	355	279	248	882
Glenn.....	284	242	97	623	280	108	114	592	306	210	70	586	301	224	76	601	229	148	53	430	209	103	36	348
Humboldt.....	389	258	174	821	336	200	151	777	284	249	156	689	393	319	205	917	525	361	193	1,069	378	273	156	807
Imperial.....	1	1	1	3	2	2	2	6	2	1	1	4	1	1	1	3	1	1	1	3	1	0	3	4
Inyo.....	74	48	51	173	89	70	74	239	96	81	76	253	88	76	87	251	87	64	60	211	71	57	52	180
Kern.....	83	72	63	218	129	82	84	295	135	103	59	297	130	101	93	324	160	121	73	354	86	62	48	196
Kings.....	3	3	3	9	1	2	2	5	2	1	1	4	9	1	2	12	2	4	4	10	4	5	4	13
Lake.....	599	229	73	901	695	267	76	1,038	583	194	64	841	585	227	73	885	501	172	53	726	332	137	55	524
Lassen.....	20	80	190	290	29	146	221	393	35	166	310	511	35	186	364	585	26	215	366	607	23	192	203	508
Los Angeles.....	279	92	54	425	256	70	43	369	470	150	71	691	437	144	56	637	678	180	91	949	593	159	62	810
Madera.....	96	77	57	230	126	84	90	300	122	91	100	313	148	124	107	379	186	133	123	442	117	89	110	316
Marin.....	297	58	12	367	362	68	14	444	337	48	9	394	347	46	10	403	385	54	10	449	323	46	7	376
Mariposa.....	32	31	33	96	50	47	37	134	53	52	39	144	80	72	83	235	87	57	46	190	50	43	41	134
Mendocino.....	853	426	106	1,475	791	477	200	1,468	728	422	206	1,356	822	456	205	1,483	1,014	496	106	1,706	710	384	179	1,273
Merced.....	41	21	5	67	45	16	7	68	29	15	4	48	45	17	6	68	42	15	3	60	26	13	6	45
Modoc.....	188	372	510	1,070	269	460	729	1,458	300	535	835	1,670	375	754	1,129	1,854	571	915	1,486	0	345	571	916	916
Mono.....	14	7	15	36	12	11	32	55	32	20	24	76	19	25	29	73	35	30	45	110	29	36	29	94
Monterey.....	541	161	56	758	536	217	77	830	502	173	59	734	577	211	76	861	635	187	78	900	342	100	42	484
Napa.....	242	155	45	442	327	179	63	569	332	149	42	523	337	142	57	536	333	114	41	458	184	89	31	304
Nevada.....	38	48	39	125	51	44	45	140	62	47	60	169	93	60	74	236	84	68	77	229	53	38	53	144
Orange.....	24	17	15	56	36	22	11	69	50	22	9	81	49	27	14	90	73	24	17	114	51	25	11	87
Placer.....	121	105	115	341	125	126	95	346	112	124	99	335	126	109	105	340	139	118	104	361	104	93	74	271
Plumas.....	177	169	205	551	177	102	217	586	233	194	268	695	279	196	289	764	337	280	351	968	275	257	297	829
Riverside.....	170	82	71	323	120	76	53	249	216	98	95	404	337	163	129	629	357	189	117	663	250	135	73	488
Sacramento.....	1	1	1	3	1	1	1	3	1	1	1	3	1	1	1	3	1	1	1	3	1	1	1	3
San Benito.....	150	54	13	217	210	90	20	320	180	67	22	269	107	89	27	313	205	54	16	275	106	29	17	152
San Bernardino.....	32	21	21	74	57	34	31	122	66	29	25	120	80	50	58	188	111	63	63	237	73	45	69	187
San Diego.....	95	38	36	169	120	76	36	232	114	66	53	233	141	65	44	250	175	98	61	334	142	76	45	263
San Francisco.....	13	8	21	42	10	4	14	28	18	4	22	44	12	7	3	22	17	5	2	24	10	2	3	15
San Joaquin.....	251	103	40	394	290	112	48	450	255	140	60	455	353	126	89	568	347	147	58	552	226	93	58	377
San Luis Obispo.....	61	13	3	77	83	4	2	89	78	22	2	102	81	14	5	100	88	10	5	103	63	19	3	785
San Mateo.....	424	154	91	669	525	204	121	850	445	164	103	717	471	204	102	777	506	180	69	755	345	126	61	532
Santa Barbara.....	243	119	35	397	371	134	31	536	403	131	43	577	461	138	51	650	515	136	46	697	322	76	17	415
Santa Clara.....	69	6	3	78	81	7	4	92	84	16	2	102	101	12	2	115	107	15	5	127	67	12	6	85
Santa Cruz.....	171	240	201	612	175	230	198	603	190	267	245	702	293	237	215	655	222	281	270	773	149	176	202	527
Shasta.....	27	27	47	101	26	30	49	102	44	42	46	132	42	38	57	137	65	47	78	190	45	45	60	151
Sierra.....	424	401	750	1,665	450	522	682	1,654	218	366	627	1,211	270	478	624	1,372	297	517	702	1,516	149	300	447	896
Siskiyou.....	22	16	7	45	30	15	7	52	31	20	3	54	41	13	4	58	34	9	2	45	17	13	1	31
Solano.....	519	188	44	751	506	194	53	753	469	216	47	732	532	263	70	865	537	251	65	903	478	180	51	709
Sonoma.....	53	26	12	91	69	28	18	115	77	33	9	119	60	36	9	111	61	28	5	94	25	8	4	37
Stanislaus.....	1	1	1	3	2	1	1	4	1	1	1	3	1	1	1	3	1	1	1	3	1	1	1	3
Sutter.....	286	288	225	799	280	329	237	846	284	262	212	758	343	247	255	845	263	271	181	715	208	173	106	487
Tehama.....	290	339	283	912	295	310	195	800	234	277	240	751	249	321	190	760	309	311	221	841	130	167	121	418
Trinity.....	341	200	203	744	484	250	205	939	301	257	189	897	418	319	228	965	400	254	236	890	293	231	202	725
Tulare.....	64	72	77	213	74	88	51	213	70	74	68	212	100	95	85	280	116	120	93	329	69	68	75	215
Tuolumne.....	164	74	30	268	226	99	37	362	233	75	38	346	208	74	26	308	255	99	35	390	210	66	41	317
Ventura.....	55	39	21	115	97	46	26	169	100	49	27	176	130	61	23	214	121	57	13	191	70	53	15	138
Yolo.....	24	19	10	53	22	21	9	52	23	14	18	55	43	33	17	93	34	28	29	91	14	9	11	34
Yuba.....	1	1	1	3	1	1	1	3	1	1	1	3	1	1	1	3	1	1	1	3	1	1	1	3
Totals.....	9,069	5,688	4,750	19,507	10,113	6,537	4,865	21,515	9,823	6,282	5,117	21,222	11,085	7,172	5,875	24,132	12,087	7,545	6,173	25,805	8,492	5,429	4,459	18,380

STATEMENT OF INCOME

For the Period July 1, 1932, to March 31, 1933, of the Eighty-fourth Fiscal Year

License sales	Detail	Total
Departmental income:		
Angling licenses, 1931.....	\$927 00	
Angling licenses, 1932.....	309,983 00	
Angling licenses, 1933.....	5,637 00	
Commercial hunting club licenses, 1932-33.....	2,075 00	
Commercial hunting club operators licenses, 1932-33.....	565 00	
Deer tags, 1932.....	94,492 75	
Fish breeders' licenses, 1932.....	40 00	
Fish breeders' licenses, 1933.....	335 00	
Fish importers' licenses, 1932.....	10 00	
Fish importers' licenses, 1933.....	65 00	
Game breeders' licenses, 1932.....	95 00	
Game breeders' licenses, 1933.....	740 00	
Hunting licenses, 1931.....	208 20	
Hunting licenses 1932-33.....	306,359 50	
Kelp licenses, 1932.....	30 00	
Kelp licenses, 1933.....	20 00	
Market fishermen's licenses, 1932-33.....	23,090 00	
Market fishermen's licenses, 1933-34.....	130 00	
Trapping licenses, 1932-33.....	1,535 00	
Wholesale fish packers' shell fish dealers' licenses, 1932-33.....	885 00	
Total license sales.....		\$747,222 45
Other income:		
Contributions from importers.....	\$185 00	
Court fines.....	22,943 56	
Fish packers' tax.....	81,403 46	
Fish tag sales.....	1,575 95	
Game tag sales.....	126 21	
Interest on bank balances.....	5,313 00	
Kelp tax.....	3 02	
Lease of kelp beds (Kelco).....	1,025 60	
Miscellaneous sales.....	12 00	
Publication sales.....	468 05	
Total other income.....		\$113,146 45
Total departmental income.....		\$860,368 90
Income for the State University Fund:		
Kelp tax.....		\$1 50

STATEMENT OF EXPENDITURES

For the Period July 1, 1932, to March 31, 1933, of the Eighty-fourth Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Bureau administration:					
Executive.....	\$7,100 01				\$7,100 01
Clerical and office.....	16,292 41	\$712 35	\$325 52	\$184 50	17,514 78
Printing.....		3,752 85			3,752 85
Automobiles.....		347 75	318 74	1,029 00	1,695 49
Traveling.....			2,411 88		2,411 88
Postage.....			3,204 08		3,204 08
Telephone and telegraph.....			2,416 42		2,416 42
Freight, cartage and express.....			1,783 87		1,783 87
Rent.....			11,860 26		11,860 26
Accident and death claims.....			3,140 48		3,140 48
Accounting pro rata.....	3,375 00		67 80	187 10	3,375 00
Legal.....	2,700 00		1,106 02		2,954 90
Premiums on bonds.....			14 02		1,103 02
Publicity.....					14 02
Total bureau administration.....	\$29,467 42	\$4,812 95	\$26,649 09	\$1,400 60	\$62,330 06
Bureau education and research:					
Chief and assistants.....	\$2,925 00				\$2,925 00
Clerical and office.....	1,440 00	\$32 93	\$95 83		1,508 76
Traveling.....			2,475 51		2,475 51
Photographer.....			113 64	\$215 03	328 67
Librarian.....	1,530 00	24 88	77 01	84 50	1,716 39
Research.....	4,950 00	26 44		11 80	4,988 24
Publicity.....	2,700 00		34 36		2,734 36
Lecturer.....	1,575 00				1,575 00
Total bureau education and research.....	\$15,120 00	\$84 25	\$2,796 35	\$311 33	\$18,311 93
Bureau patrol and law enforcement:					
Chief and assistants.....	\$8,325 00				\$8,325 00
Clerical and office.....	2,385 00	\$40 68	\$2 78	\$5 97	2,434 43
Automobiles.....		11,116 41	4,847 04	5,971 24	21,935 59
Traveling.....			65,756 70		65,756 70
Postage.....			466 93		466 93
Telephone and telegraph.....			1,221 16		1,221 16
Freight, cartage and express.....			15 50		15 50
Rent.....			310 04		310 04
Heat, light and power.....			10 00		10 00
Captains and deputies.....	150,250 22	572 65	514 11	41 01	151,377 99
Launches.....		1,316 10	1,344 24	67 66	2,728 00
Fish planting.....	3,465 00	235 33	1,077 05	137 50	4,904 88
Premiums on bonds.....			1,787 56		1,787 56
Statistical.....			168 00		168 00
Temporary help.....	89 34				89 34
Cooks.....	1,125 00				1,125 00
Commercial fisheries patrol:					
Chief and assistants.....	2,070 00				2,070 00
Captains and wardens.....	12,420 00	5 13	40 15		12,465 28
Launches.....	9,167 00	2,552 44	1,226 29	141 57	13,087 30
Fish cannery inspectors—					
Seasonal.....	14,950 02				14,950 02
Travel.....			6,030 73		6,030 73
Rent.....			560 00		560 00
Automobiles.....		163 63	46 83		210 52
Temporary help.....	253 34				253 34
Total bureau patrol and law enforcement.....	\$204,499 92	\$16,052 37	\$85,426 07	\$6,364 95	\$312,343 31
Bureau commercial fisheries:					
Chief and assistants.....	\$10,215 00				\$10,215 00
Clerical and office.....	7,200 00	\$87 02	\$53 50	\$11 94	7,352 46
Automobiles.....		223 55	151 29		374 84
Traveling.....			4,894 04		4,894 04
Postage.....			54 75		54 75
Telephone and telegraph.....			410 16		410 16
Freight, cartage and express.....			238 26		238 26
Rent.....			306 78		306 78
Heat, light and power.....			310 34		310 34
Research.....	2,507 84	70 40		18 51	2,605 75
Launches.....				1,386 00	1,386 00
Laboratory.....	10,354 48	387 30	792 40	223 84	20,758 02
Hydrobiological survey—Monterey Bay.....			750 00		750 00
Statistics.....		891 04	1,302 66	1,002 50	3,199 20
Fish cannery research.....			3,750 00		3,750 00
Total bureau commercial fisheries.....	\$39,277 32	\$1,671 31	\$13,014 18	\$2,642 79	\$56,605 60

STATEMENT OF EXPENDITURES

For the Period July 1, 1932, to March 31, 1933, of the Eighty-fourth Fiscal Year—Continued

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Bureau fish culture:					
Chief and assistants.....	\$8,370 00	\$2 00			\$8,372 00
Clerical and office.....	3,060 00	0 79	\$28 88	\$5 97	3,104 64
Automobiles.....		4,364 48	1,043 23	1,993 49	8,306 20
Traveling.....			8,167 55		8,167 55
Postage.....			126 76		126 76
Telephone and telegraph.....			956 48		956 48
Freight, cartage and express.....			601 02		661 02
Rent.....			1,745 45		1,745 45
Heat, light and power.....			979 89		979 89
Hatcheries.....	89,080 97	52,297 11	1,546 12	2,256 82	145,781 02
Special field investigations.....	5,172 74	29 14	10 25	80 73	5,292 86
Fish cars.....	2,655 00	258 39	718 69		3,632 08
Blue printing.....			11 36		11 36
Cooperative research.....	2,445 00	273 81	1,400 00	803 84	5,012 65
Temporary help.....	1,576 75				1,576 75
Fish hatchery assistant—seasonal.....	16,473 48				16,473 48
Total bureau fish culture.....	\$129,433 94	\$57,294 72	\$18,385 08	\$5,145 85	\$210,200 19
Bureau hydraulics:					
Chief and assistants.....	\$6,255 00				\$6,255 00
Clerical and office.....		\$21 67	\$47 00	\$46 07	114 74
Automobiles.....		366 04	163 71	563 88	1,093 63
Traveling.....			1,235 78		1,235 78
Postage.....			3 00		3 00
Telephone and telegraph.....			3 00		3 00
Total bureau hydraulics.....	\$6,255 00	\$387 71	\$1,452 49	\$609 95	\$8,705 15
Bureau game propagation:					
Superintendents.....	\$2,475 00				\$2,475 00
Automobiles.....		\$769 71	\$216 19		985 90
Traveling.....			3,454 64		3,454 64
Postage.....			24 37		24 37
Telephone and telegraph.....			174 91		174 91
Freight, cartage and express.....			14 19		14 19
Heat, light and power.....			747 50		747 50
Maintenance.....	9,333 00	6,983 88	605 70	\$28 00	16,950 58
Temporary help.....	2,211 00				2,211 00
Quail trapping and expansion of quail program.....	4,626 39	506 31	73 72	37 99	5,244 41
Total bureau game propagation.....	\$18,645 39	\$8,259 90	\$5,311 22	\$65 99	\$32,282 50
Bureau fish rescue:					
Chief and assistants.....	\$3,600 00	\$31 00	\$9 00		\$3,640 00
Traveling.....			1,255 45		1,255 45
Rent.....			110 00		110 00
Temporary help.....	104 50				104 50
Total bureau fish rescue.....	\$3,704 50	\$31 00	\$1,374 45		\$5,109 95
Bureau game refuge:					
Chief and assistants.....	\$6,374 97				\$6,374 97
Clerical and office.....	1,440 00	\$41 40	\$27 40		1,508 80
Automobiles.....		545 08	127 53	\$600 00	1,273 51
Traveling.....			3,253 42		3,253 42
Telephone and telegraph.....			90		90
Lion hunters and trappers.....	6,328 00				6,328 00
Refuge posting.....	540 00	7 84			547 84
Predatory animal control.....			5,240 00		5,240 00
Temporary help—seasonal.....	5,589 71				5,589 71
Refuge maintenance.....	4,995 00	1,320 56	1,607 75		7,923 31
Predatory animal hunters and trappers—seasonal.....	7,525 00				7,525 00
Fences.....				6,510 73	6,510 73
Total bureau game refuge.....	\$32,792 68	\$1,915 78	\$10,257 00	\$7,110 73	\$52,076 19
Prior year—83d fiscal year.....					\$9,873 13
Total paid from support—83d and 84th fiscal years.....					\$767,838 01

STATEMENT OF EXPENDITURES

For the Period July 1, 1932, to March 31, 1933, of the Eighty-fourth Fiscal Year—Continued

Special items	Total
Construction, improvements and equipments:	
Bass ponds.....	\$832 91
General repairs, improvements and construction of cottage at the Brookdale Hatchery.....	1,706 77
Lake Elinor egg collecting station.....	231 12
Tank and egg collecting station at Huntington Lake.....	77 74
Kaweah garage project.....	187 33
Klamathon Station—station and dry room project.....	310 04
Klamathon station—warehouse project.....	156 00
Kosk Creek egg collecting station project.....	236 30
Repairs and improvements at Mt. Shasta Hatchery.....	368 04
Maintenance and improvements—Navarro River jetty.....	33 79
Opening Salinas River channel.....	54 36
Sebastopol bass rearing ponds.....	351 88
Total construction, improvements and equipment.....	\$4,547 48
License commissions.....	\$35,716 92
Purchase of game refuges.....	34,804 04
State Fair and other exhibits.....	1,291 97
Construction, Russian River jetties—Chap. 60-1931, or executive order No. 605—84th fiscal year.....	133 45
Deer tight fences—Chap. 872-31, from January 1, 1933, to June 30, 1933.....	1,554 30
Deer tight fences—Chap. 872-31, from July 1, 1932, to December 31, 1932.....	1,641 60
Electro Metals Company's claim—Chap. 599-1931.....	18,750 00
Total special items.....	\$98,440 66
Prior year expense—82d fiscal year.....	6 60
Grand total proprietary group.....	\$866,285 27

GAME CASES

January, February, March, 1933

	Number arrests	Fines imposed	Jail sentences (days)
Deer; closed season; killing does, selling deer meat.....	93	\$2,134 50	940
Ducks; closed season.....	40	467 00	80
Hunting license Act; violations of.....	13	255 00	5
Mountain sheep; killing of.....	1		50
Night hunting.....	1		12½
Nongame birds; killing of.....	10	150 00	
Pheasants; closed season.....	11	200 00	70
Pigeons; closed season.....	6	85 00	
Quail; closed season.....	11	120 00	
Netting game birds.....	3	75 00	
Rabbits; closed season.....	9	95 00	42½
Tree squirrels; killing of.....	1		
Swan; closed season.....	1		90
Trespassing on posted ground.....	3		45
Using a spiked tooth trap.....	1	5 00	
Commercial gun club; no license.....	1		
Totals.....	205	\$3,596 50	1,335

FISH CASES

January, February, March, 1933

	Number arrests	Fines imposed	Jail sentences (days)
Abalones; small; overlimit	20	\$240 00	90
Angling License Act; violations of	15	275 00	
Bass—			
Striped; small	7	35 00	
Black; small	2	70 00	
Clams; small; overlimit	29	300 00	185
Crabs; small	6	60 00	
Commercial Fishing License Act; violations of	18	10 00	20
Cockles; overlimit	1	25 00	
Lobsters; small	9	65 00	37½
Mussels; overlimit	7		50
Night fishing	2		50
Pollution of stream	1	200 00	
Seines and nets; illegal use of	17	175 00	236
Trout; closed season; spearing of; overlimit	44	505 00	131
Yellowfin; small	2	50 00	
Failure to keep record of fishing data	6	50 00	50
Perch; closed season	5		25
Hopkins Marine Life Refuge; fishing in	1	5 00	
Illegal fishing apparatus	5	100 00	
Totals	201	\$2,165 00	874½

SEIZURES OF FISH AND GAME

January, February, March, 1933

Fish:	706
Abalones	
Bass—	
Black	24
Calico	6
Striped (fish)	47
Striped, pounds	222
Clams	1,098
Crabs	50
Cockles, pounds	134
Crappie, perch, pounds	28
Croaker, pounds	6½
Halibut, pounds	266
Lobster, pounds	1,866
Mussels, pounds	247
Trout, pounds	1,145
Trout (fish)	103
Yellowfin pounds	24,104
Traps, lobster	46
Game:	18
Deer	1,126
Deer meat, pounds	333
Ducks, geese	80
Nongame birds	10
Pheasants	32
Pigeons	3
Quail	6
Rabbits	1
Squirrel, trees	

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF JANUARY, FEBRUARY AND MARCH, 1933

Compiled by Division of Fish and Game, Bureau of Commercial Fisheries

Species of fish	Del Norte, Humboldt.....	Mendocino, Sonoma, Lake.....	Marin.....	Solano, Yolo.....	Sacramento, San Joaquin.....	Alameda, Contra Costa.....	San Francisco, San Mateo.....	Santa Cruz.....	Monterey.....
Anchovy.....							2,300		3,640
Barracuda.....								24	5
Bonito.....									
Cabrilla.....									
Carp.....		10,035		600	2,587	2,750			
Catfish.....				112	13,993	6,600			
Cultus.....	7,639	2,540					133,647	13,306	23,937
Flounder.....	10,850	2,470					48,953	11,283	466
Hake.....	250					35	1,680	280	
Halfmoon.....									
Halibut—California.....							6,133	8,004	1,792
Halibut—Northern.....	569						2,656		
Hardhead.....		52,550			7,829				
Herring.....			209,385			2,250	146,815		7,695
Kelp Bass.....								4,463	27,926
Kingfish.....									3,314
Mackerel—Horse.....									77,295
Mackerel—Pacific.....									
Mackerel—Spanish.....									
Mullet.....									
Perech.....	784	2,141	20,085						
Pike.....				31	240	13	9,505	463	19,915
Porapano.....						223			
Ray.....									55
Rock Bass.....									
Rockfish.....	22,968	9,891							
Sablefish.....	609	125					233,868	140,521	366,378
Salmon.....				1,925	9,517	12,784	22,211	52,886	2,000
Sanddab.....	11,601	5,720					127,122	4,720	3,096

Sardine.....							12,133,262	1,120	51,893,423
Sculpin.....							1,324		
Sea Bass—Black.....									
Sea Bass—White.....			248				771		202
Shad.....				9,743	4,648	79,735	9,050	5	
Shark.....	2,100						48,552	700	30
Sheepshead.....									
Skate.....	150	650					62,976	710	6,449
Skipjack.....									
Smelt.....	12,831	186	10,710			3,350	59,752	1,003	11,718
Smelt—Jack.....	1,013		1,828					33	
Sole.....	192,002	62,908					1,854,761	62,988	6,755
Splittail.....		1,950				152			
Striped Bass.....			34	5,778	26,550	164,724	8,350		
Sucker.....		2,379			126				
Tuna—Yellowfin.....									
Turbot.....	150		20				15,088		
Whitebait.....	8,720	2,001	348				13,284		177
Whitefish.....									
Yellow-tail.....									
Miscellaneous.....	13,723	635			5		9,513	2,625	1,066
Total fish.....	285,965	163,379	243,258	18,189	65,662	272,009	14,951,573	305,134	52,467,334
Crustaceans:									
Crab.....	39,482	2,208	60			2,004	598,928	67,872	15,424
Shrimp.....			60,938			11,393	187,092		223
Spiny Lobster.....									
Mollusks:									
Abalone.....									237,775
Clam—Hardshell.....		131	29,832						
Clam—Mixed.....	9,202	642							
Clam—Pismo.....								1,075	11,826
Clam—Softshell.....		244	34,515			2,065	33		
Octopus.....		115					1,726		1,910
Oyster—Eastern and Japanese.....			32,425				64,042		14,096
Oyster—Native.....							5,525		
Squid.....									102,076
Totals.....	334,649	166,719	401,028	18,189	65,662	288,731	16,109,519	374,031	52,850,673

All amounts shown in pounds unless otherwise specified. Skipjack and Albacore cleaned.

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF JANUARY, FEBRUARY AND MARCH, 1933—Continued

Compiled by Division of Fish and Game, Bureau of Commercial Fisheries

Species of fish	San Luis Obispo, Santa Barbara, Ventura.....	Los Angeles.....	Orange.....	San Diego, Imperial.....	Total.....	Fish from south of the International Boundary brought into San Pedro.	Fish from south of the International Boundary brought into San Diego.	Total fish from south of the International Boundary brought into California.
Anchovy.....		4,793			10,733			
Barracuda.....	14,003	170,521	11	4,414	189,938	105,344	1,034	107,278
Bonito.....	28	6,030	763	1,512	8,333		1,285	1,285
Cabrilla.....						404	65,982	66,386
Carp.....					22,581			
Catfish.....					20,705			
Cultus.....	112	138	11,208		197,587			
Flounder.....		787	102	22	74,074			
Hake.....			925		3,135			
Halfmoon.....		4,390	0		4,399			
Halibut—California.....	64,229	164,373	25,046	59,741	330,218	62	7,218	7,280
Halibut—Northern.....					3,225			
Hardhead.....					60,370			
Herring.....	45	8			366,444			
Kelp Bass.....		290		240	290			
Kingfish.....		103,419	1,231	602	137,641			
Mackerel—Horse.....		41,000			50,304			
Mackerel—Pacific.....	1,080	1,072,294	102,331	66,422	1,319,422			
Mackerel—Spanish.....						650	390	1,040
Mullet.....		817		4,893	5,710		2,227	2,227
Perch.....	2,577	17,276	13	30	73,402			
Pike.....					503			
Pompano.....		370			425		710	710
Ray.....		685	206		801			
Rock Bass.....	1,730	27,078	5,956	28,526	61,890	2,321	3,811	6,132
Rockfish.....	18,091	460,569	9,369	237,949	1,409,604		4,940	4,940
Sablefish.....		31,556	30,589	900	140,876			
Salmon.....					24,226			
Sanddab.....		1,335	85		153,679			

Sardine	477	101,572,365		2,082	165,002,720			
Sculpin		5,871	1,759	2,228	11,182			
Sea Bass—Black	597	21,797	2,228	28,378	53,000	42,202	37,000	79,202
Sea Bass—White	35,803	54,372	1,860	13,911	107,167	325	1,030	1,355
Shad					103,181			
Shark	5,208	42,136	7,242	14,821	120,849			
Sheepshead	3,347	13,290	246	525	17,417			
Skate		8,176	2,250	560	81,921			
Skipjack						390,145	1,139,096	1,538,541
Smelt	1,961	67,046	24	7,947	176,528			
Smelt—Jack	13,477	2,688			19,039			
Sole	139,845	18,912	251	2,825	2,341,245			
Splittail					2,208			
Striped Bass					205,442			
Sucker					2,505			
Tuna—Yellowfin						2,137,405	7,100,280	9,243,745
Turbot					15,258			
Whitebait					25,130			
Whitefish		9,380	14	12,274	21,668	3,023	2,854	5,877
Yellow-tail		36,158		27,713	63,871	68,266	75,506	143,772
Miscellaneous	20	4,201	42	3,257	35,177		654	654
Total fish	303,650	103,965,810	204,720	519,778	173,767,121	2,759,597	8,450,917	11,210,514
Crustaceans:								
Crab		4,401			1,030,970			
Shrimp					260,246			
Spiny Lobster	39,782	30,000	2,501	9,833	88,206	6,774	380,228	387,002
Mollusks:								
Abalone	56,300				294,075			
Clam—Hardshell		5,742			35,705			
Clam—Mixed					9,844			
Clam—Pismo	16,175				29,070			
Clam—Softshell					36,857			
Octopus		6	4		3,770			
Oyster—Eastern and Japanese					110,563			
Oyster—Native					5,525			
Squid		54,634	157		158,667			
Totals	415,907	104,066,683	207,382	520,611	175,828,834	2,766,371	8,831,145	11,597,516

All amounts shown in pounds unless otherwise specified. Skipjack and Albacore cleaned.

ABSTRACT
CALIFORNIA SPORTING FISH AND GAME LAWS
VALID UNTIL 90 DAYS AFTER CLOSE OF 1933 LEGISLATURE

1931 OPEN AND CLOSED SEASONS 1932
WHITE SQUARES INDICATE OPEN SEASON. NUMBERS IN SQUARES ARE OPEN DATES

GAME	DISTRICTS	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	BAG AND POSSESSION LIMITS, ETC.
DEER	1 1/2										15			No Does, Fawns or Spike Bucks No Forked Horned Deer in Dist. 1 1/2 No sale of Venison or Deer Skins Two Bucks per Season except in 1 1/2 where limit is one See Notes 6-9-10-12
	2-2 1/2-3									14				
	1-1 1/2-4-4 1/2-4 3/4-23 24-25										16 15			
Rabbits—Cottontail and Brush	ALL EXCEPT 4 3/4											15 12		15 per day. 30 per week. No limit in District 4 No protection in 4 3/4
Bear, Fur Animals	ALL											15		See Note 7 Predatory animals specified in Districts 2-2 1/2-3-4-4 1/2
Ducks, Geese, Jack Snipe, Mud Hens	ALL FEDERAL LAW STATE LAW	13												15 Ducks, 10 in Possession; 4 Geese, 8 in Possession; 20 Snipe, 25 Mud Hens, No Ross Snow or Cocking Geese 25 Ducks, 25 Snipe, 25 Mud Hens, 50 Per Week Game Limit See Note 4. See Notes 9-10-11-12-13
Quail—Valley, Desert and Mountain	ALL EXCEPT 1 1/2											15 15		Valley and Desert 15 per day. 30 per week Mountain 10 per day. 20 per week
	1 1/2													
Dove	ALL EXCEPT 4-4 1/2-4 3/4													Federal Season Open Nov. September 1 15 per day 30 per week
	4-4 1/2-4 3/4													

There is no open season on Elk, Antelope, Mountain Sheep, Sea Otter, Tree Squirrel, Sierra Hare, Rail, Wood Duck, Pigeon, Swan, Shore Birds (except Jack Snipe), Grouse, Sage Hen, Imported Quail, Wild Pheasant, Partridge, or Wild Turkey.

FISH	DISTRICTS	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	BAG AND POSSESSION LIMITS, ETC.
Steelhead and all Trout (except Golden), Whitefish	1-1 1/2-1 1/2-2-3-4-4 1/2-4 3/4-15 Klamath River, Lake Almanor													No Sale No Spearfishing For other restrictions See Notes 12-15-16-20 21-22-28-29 31-33 On this Card
	2 1/2		23			30								
	23-24-25					30								
	Truckee River					15								
	See Note 22													
Unlawful to take trout in waters closed by Gov. ernor's proclamation	1 1/2-2-3-4-4 1/2-4 3/4-15 Winter Klamath River													5 Trout regardless of weight
	Russian, Navarro, Hapa and Col. Desd. 2) Taken after Dist. 2-3-15													1 Trout regardless of weight
Golden Trout	ALL													20 per day. None under 5 inches Not more than 10 lbs. and one
BLACK BASS	ALL EXCEPT 4 3/4													15 per day in District 4 3/4 Clear Lake 10 per day
	CLEAR LAKE IN LAKE CO.													No Black Bass under 9 lbs. No sale Hook and line only
Sunfish	ALL													25 per day
Sacramento Perch and Crappie	ALL EXCEPT CLEAR LAKE													25 per day
	CLEAR LAKE													10 per day Hook and line only No sale
Striped Bass	1-3-12A													None under 12 inches. 5 per day. None to be taken from Salton Sea. See Note 19
Crabs	ALL EXCEPT 1 1/2-6-7-8-9							30				15		Season Districts 1 1/2-4-7-8-9 August 11, December 14 See Note 24, None under 7 inches. No Female
Abalones	ALL	14			16									Only for food. Must be brought to shore alive in shell Angling License Required. See Note 27
Pismo Clams	17													None under 5 inches. No shipment. 15 per day Angling License Required. District 18a Closed
Spiny Lobster	ALL										15			No Sale of Meat. None under 10 1/2 or over 16 inches See Note 24
GRUNION	ALL													

Salmon and Shad May Be Taken as Noted in Paragraphs 19-23. No open season on Sturgeon (possession prohibited).

NOTES

IT IS ALWAYS UNLAWFUL

- To hunt, kill, possess wild birds or mammals, to possess firearms, except under written permit from the Commission, within districts 1a, 1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i, 1j, 1k, 1m, 1n, 1o, 1p, 1q, 1r, 1s, 1t, 1u, 1v, 1w, 1x, 1y, 1z, 2a, 2b, 2c, 2d, 2e, 2f, 2g, 2h, 2i, 2j, 2k, 2l, 2m, 2n, 2o, 2p, 2q, 2r, 2s, 2t, 2u, 2v, 2w, 2x, 2y, 2z, 3a, 3b, 3c, 3d, 3e, 3f, 3g, 3h, 3i, 3j, 3k, 3l, 3m, 3n, 3o, 3p, 3q, 3r, 3s, 3t, 3u, 3v, 3w, 3x, 3y, 3z, 4a, 4b, 4c, 4d, 4e, 4f, 4g, or General Grant Refuge, or the Mt. Tamalpais Game Refuge, including Richardson Bay, or San Francisco Refuge, or Silver Lake Refuge (water fowl may be killed in 4a and 4b), or to hunt quail in the Bolinas Quail Refuge, or to hunt or discharge firearms in Huntington Lake Refuge or San Leandro Bay Refuge.
- To hunt birds or mammals excepting predators without a hunting license.
- To possess any bird net or to net, trap or to hold protected game or birds of any kind, their nests or eggs except under written permit from the Commission.
- To take or possess more than 8 geese per day or 50 per week; or more than 8 honkers or sea brant per day or 24 per week.
- To take or kill non-game birds, except blue jay, butcher bird, English sparrow, sharp-shinned, Cooper or duck hawk, great horned owl, linnet, white pelican, shag, and in districts 1, 2, 3, 4 and 4 1/2, blackbirds.

- To hunt deer without a deer tag license. To fail to attach to the horns of deer immediately on killing, properly filled out license tag or at the same time to send duplicate tag to the Division. To carry a deer into a closed district without having license tag countersigned, or to have untagged deer in possession. To fail to retain in possession during open season and for ten days after the skin and portion of head bearing horns of deer killed and to produce upon demand. To use more than one dog to the hunter in hunting deer or to allow dogs to run deer in closed season, or to possess doe or fawn skins, or deer skins not bearing evidence of sex.

- To trap for profit bear, ring-tailed cat, coon, pine marten, skunk, fisher, wolverine, mink, river otter, fox, beaver or muskrat, or to kill these animals during the closed season, except when destroying property. To interfere with the traps of licensed trappers. To use saw tooth or spike jawed traps for taking fur bearers.

- To use any animal other than a dog to stalk wild birds.
- To shoot game from a power boat, sailboat, auto, airplane; or to hunt waterfowl from a sailboat in districts 8, 9, except on Wednesdays and Sundays, or at any time in district 12 or Napa River south of Edgerly Island, or to use a

shotgun larger than ten gauge, or to possess an extension automatic or a cane gun.

10. To shoot resident game between 1 hour after sunset and 1 hour before sunrise, or migratory game between sunset and 1 hour before sunrise. To use a spotlight in hunting game.

11. To hunt waterfowl in districts 4, 43, 49, 46, 19, 20, 20a, 22, other than on Wednesdays, Saturdays, Sundays, legal holidays, opening and closing days; or in district 4a except between 8 a.m. and sunset. To drive game birds by means of auto, airplane, or power boat over shooters.

12. To hold game or fish longer than 5 days after close of season, venison 15 days.

13. To sell wild game, except cottontail and brush rabbits.

14. To make a false statement in applying for license. To fail to show license upon demand to any officer.

15. To take game or fish from one district to another when season is not open in both. (Special law for deer and trout.) Trout legally taken may be transported from an open district into a closed district by the consignee making an affidavit in duplicate setting forth his name, address, number of angling license and name and address of consignee. The original must be attached to the shipment, the copy left on file with the officer before whom sworn. Trout may be shipped into closed district when accompanied by written statement to the effect that trout were legal, signed by shipper, countersigned by agent to whom offered for shipment.

16. To ship wild birds, mammals, or fish except smoked or dried fish other than trout by parcel post, or in concealed packages or without a tag bearing name and address of consignee and consignor and contents, or to ship game out of state.

17. To operate a commercial hunting club without license.

18. To place obstructions in streams in districts 1, 13, 2, 21, 3, 4, 41, 23, 24, and 25 that will stop or impede fish.

19. To buy, sell or ship striped bass less than 20 inches in length, or to ship striped bass out of state, or to ship striped bass during closed season to take other than with hook and line. To possess more than five shad per day between May 16 and July 31, or September 17 and November 14.

20. To take trout other than with rod and line held in the hand or with lure with more than 2 attractor blades or more than 3 hooks.

21. To have in possession any fish spear or gaff (except landing gaff) within 300 feet of any lake or stream when unlawful to spear salmon.

22. To take trout in any lake within 300 feet of the mouth of any stream from October 31 to August 1, or in that portion of any stream flowing into any lake in Districts 23 and 24 within two miles from its mouth, upstream, from October 31 to August 1.

23. To take salmon on spawning beds or within 10 miles of a spawning station or 3 miles north and south of mouth of Klamath River; to take in ocean and Humboldt Bay districts Chinook less than 27, or Silver less than 24 inches, or to gaff or club undersized salmon, or to bring ashore in such condition that the size can not be taken, or to not have a landing

net in any salmon boat. To take more than 2 salmon per day in districts 1, 11, 2, 23, Klamath River (above tidewater), 3, 12a, Klamath River tide except between July 1-September 5; to spear salmon except in districts 1, 13, 2, 21, Klamath River above tidewater; to take salmon in any way except between dates given—district 1 May 29-October 31; 13, Klamath River May 29-December 31; 2, 21, May 1-February last; 3, 12a May 1-October 31; to take or possess salmon last; except between dates given—districts 6, 7, 8, 9, May 1-September 15; districts 10, 11, May 1-August 15; districts 15, 16, 17, 18, April 1-June 30; to spear salmon except between dates given—district 1 May 29-October 31; 13 and Klamath River above tide August 1-October 31; 2, 21 November 1-February last.

24. To bring to shore crabs or lobsters in such condition that the size can not be taken; or to ship or carry crabs out of districts 12, 21, 5, 6, 7, 8, or 9.

25. To take or possess in district 3 salt water eels of less than 12 inches or more than 15 per day.

26. To take or possess cockles less than 1 1/2 inches in diameter, or to take or possess more than 15 (Dist. 10) Washington clams or more than 10 horse clams or more than 50 razor clams per day, or in districts 18, 19, 21 more than 15 pounds of mussels per day.

27. To take red abalones less than 7 inches in the greatest diameter; green, 6 1/2; pink, 6; black, 5; to dry abalones; to give for abalones in districts 7, 15, 16, 17, 19, 20 and 20a; to take more than 10 per day or 20 per week in districts 7, 15, 16, 17, 19, 20 and 20a. To take more than 10 per day from shore in districts 7, 16 and 18; to take more than 10 black abalones per day in districts 14, 15, 17, 18, 19, 20, 20a, 21.

28. To fish for game fish without having an angling license.

29. To take game fish between 1 hour after sunset and 1 hour before sunrise in districts 1, 13, 14, 2, 23, 3, 4, 43, 44, 23, 24, 25.

30. To fish with nets except in commercial districts.

31. To fish through the ice for any fish or to take fish in district 14.

32. To place, cause to be placed, or discharge into any waters substances deleterious to fish or plant life.

33. To fish within 250 feet of a fishway or 150 feet of the upper side of a fish screen, or the lower side of a dam, or to take fish except salmon within 1 mile of the lower side of a spawning station, or any lake within 3 miles of a spawning station when station is in operation.

34. To kill, injure or capture California sea lions in districts 19, 20, 20a.

35. To take invertebrates or marine plants in Hopkins Marine Refuge (Monterey Co.) or in that area between the west line of the property of the Scripps Institute and a line 1,000 feet west of low tide line (San Diego Co.).

36. To take more than 5 white sea bass from May 1 to June 30, or to take at any time more than 5 under 28 inches.

37. To take more than 20 pounds of halibut under 4 pounds each, or to take more than 5 barracuda less than 3 pounds each.



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R. E. CLASSIC, Captain-----Monterey
COBURN F. MADDOKX, Captain-----San Diego
N. C. Kunkel-----Terminal Island
Tate F. Miller-----Klamath | T. W. Schilling-----Pismo Beach
T. J. Smith-----San Diego

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Hugo I. Cairen-----Motor Vessel "Bluefin," Terminal Island
L. J. Weseth-----Launch "Albacore," Monterey
Erol Greenleaf-----Launch "Albacore," Monterey
C. M. Bouton-----Launch "Quinnat," San Rafael
W. J. Black-----Launch "Hunter," Vallejo
Wm. Hoppe-----Launch "Rainbow," Walnut Grove
Geo. Smalley-----Launch "Walter R. Welch," Pittsburg
T. F. Miller-----Launch "Silver-side," Klamath

Captains indicated in capitals.

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